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PETE S. CHRAPLIWY

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A New Casque-Headed Frog (*Pternohyla*) From Mexico

By Hobart M. Smith

Among the reptiles and amphibians collected in western Mexico during the summer of 1956 by a party of students (William Z. Lidicker, Jr., Wayne H. Davis, John R. Winkelmann) from the University of Illinois is a single specimen of a remarkably distinct species of the hitherto monotypic genus *Pternohyla* (Boulenger).

Pternohyla dentata sp. nov.

Holotype. An adult male, Univ. Ill. Mus. Nat. Hist., No. 40551, secured July 12, 1956, at a locality 8 mi. NE Lagos de Moreno, Jalisco, Mexico, by Wayne H. Davis, William Z. Lidicker, Jr., and John R. Winkelmann.

Diagnosis. A member of the genus *Pternohyla,* having no *bony* labial fringe, either spinous or solid, but a nearly complete coossification of cranial integument and bone. Differing from the only other species of the genus in possessing parasphenoid teeth, a rounded (not compressed) inner metatarsal tubercle, pointed tips on digits, and no pretympanic crest.

Description of the holotype. Cranial epithelium completely coossified with skull, except on lower jaw and along upper lip; dorsal and lateral surfaces of skull rough, coarsely pebbled; head flattened, eyes strongly protuberant dorsally beyond level of skull; a marked, shallow (1 mm.) median depression at level of anterior edge of orbit, bounded laterally by a rounded ridge extending from anteromedial corner of orbit to internasal area, where it disappears; nostrils small transverse oval openings (1 x 0.5 mm.), directed upward, their medial borders separated by a distance (2.6 mm.) about half the bony interorbital distance (4.6 mm.), which in turn is about equal to the distance (4.3 mm.) from the bony orbit to the nostril; latter distance about twice distance from nostril to lip (2.1 mm.); lores strongly flattened, at about a 35° angle to the horizontal; whole upper lip protuberant, flared; curve of lip at tip of snout at an abruptly lower level than that of nares, and soft (no close bony support); from a point anterolateral to nares to the tympanum, maxillary bone protruding as a marked shelflike ridge rising somewhat in a slight curve below orbit, then curving downward to meet the ridge about the

tympanum; edge of maxillary flange protruding horizontally in loreal region but upward in orbital region; maxillary flange as seen in ventral view a maximum of 2 mm. wide (measured on the horizontal, between edge of ridge and lip) at tip of snout, gradually diminishing posteriorly to about 0.5 mm. near *rictus oris;* a marked ridge at dorsal and anterior edge of orbit, ending quite abruptly at rear margin of orbit, but more gradually disappearing laterally along anterior edge of orbit; bony orbit 6.5 mm. in diameter; a strong, short supratympanic ridge, extending straight posteriorly from rear edge of orbit where it is separated by about 2 mm. from the rear end of the circumorbital ridge; no pretympanic ridge; supratympanic ridge relatively narrow anteriorly, irregularly bulbous posteriorly where it ends just dorsal to the rear edge of the tympanum; tympanum large, round, surrounded by a conspicuous tympanic ridge except above where the supratympanic ridge somewhat overhangs the tympanum; tympanum 4.6 mm. in diameter, separated from bony edge of orbit by 1.2 mm., from *rictus oris* by 1.7 mm.

Vocal sacs conspicuous, paired, external; maxillary teeth numerous, small; internal nares large, subrectangular, 1.4 mm. in diameter (both transverse and longitudinal); a large oval prevomerine eminence, perhaps two-thirds size of a choana, on each side between middle of choanae, in contact medially and narrowly (0.5 mm.) separated from choanae, bearing single row of 5 small teeth; a strong, transverse palatine ridge immediately anterior to orbit, narrowly separated (0.7 mm.) from prevomerine eminence, bearing a number of somewhat toothlike irregularities; a single row of about 7 small toothlike projections on parasphenoid; tongue large, free at rear and sides, with numerous, scattered, isolated, round papillae buried in a smooth epithelial tissue, slightly notched behind; vocal slits huge, paired, at sides of tongue attachment.

Skin of trunk conspicuously and coarsely granular, the granules varying from 1 mm. to 1.4 mm. in diameter, the smallest on sides, those on dorsal surface elongate, narrow, those elsewhere more or less rounded or with several straight sides.

No arm fringe; fingers free, in order of length, 1, 2, 4, 3, third 1.2 mm. longer than fourth; a thick, narrow fringe along edges of fingers; tips of fingers narrower than any other parts of fingers, with a small, rounded, seemingly nonadhesive tubercle similar to but smaller than subarticular tubercles; 3 palmar tubercles, the outer smallest, the inner very large; 1st digit thickened but not cornified.

Heels touching with femora at right angles to body axis; leg short, heel reaching axilla when adpressed forward along body; anus at midthigh level, with a short dorsal flap; a conspicuous vertical groove at heel; a strong inner metatarsal fold, no outer; a large, oval inner metatarsal tubercle, not cornified, attached all around, not compressed or with a cutting edge, 2.3 mm. in length, over half length of 1st toe (3.9 mm. from distal tip of tubercle); no outer metatarsal tubercle; tips of toes pointed, slender, with a small, rounded tubercle but no suction pad; free parts of each toe with a narrow, thick, fleshy fringe; webs short, formula (see Texas Journ. Sci., 4, 1952: 255) 2.3, 3.5-2.3, 4.8-3.5, 4-4.3, 3.8.

Measurements. Total length, snout—rear of thigh, 59 mm; head width at tympanum, 17.5 mm., at anterior edge of orbit 15 mm; length

of head to rear of tympanum, 16 mm; knee to knee (femora at right angles to body), 38 mm; tibia, 20 mm; foot, 28.5 mm; foreleg from axilla 23 mm.

Color. The entire dorsal coloration is darkened from the preservative, but under fluid large, apparently reddish brown blotches are seen on the back and sides, each blotch with a conspicuous black border. There is a very long blotch of this sort on either side of the median line extending from the occiput to the middle of the back. Six or seven other, more rounded or oval blotches can be seen lateral and posterior to the paravertebral streaks. Similar blotches are present on the hind legs, but the ground color of the thigh is considerably lighter than elsewhere and there the blotches are conspicuously apparent. The ground color on back and tibia is a dark slate. The rear of the thigh is relatively light, with a few scattered dark flecks; similar flecks are present on the foot and anterior edge of tibia. The head is slate-colored, and unmarked so far as can be determined. The lips appear to be somewhat lighter and mottled with black.

The ventral surfaces are light and unmarked except for an asymmetrical black dot on the upper lip and the somewhat darkened vocal pouches.

Comparisons. This species closely resembles *Pternohyla fodiens* Boulenger, having the same body build, the same general shape of head, limb proportion and even the same basic pattern. There are, however, a number of sharply-defined differences from *P. fodiens:* (1) the tips of the digits are pointed (with small but distinctly expanded pads wider than the adjacent part of digit in *fodiens*); (2) the inner metatarsal tubercle is not compressed (strongly compressed and with a free cutting edge in *fodiens*); (3) there is no pretympanic ridge (present in *fodiens*); (4) the snout is more flaring and rounded; and (5) the parasphenoid is denticulate and the palatine ridgelike and with toothlike irregularities (parasphenoid teeth absent and palatine less elevated and lacking denticulations in *fodiens*).

According to x-ray photographs taken through the courtesy of Mr. Wendell Coggshall of McKinley Hospital in Urbana, there are no denticulations or bony spines on the somewhat protuberant maxillary bone. In this respect *P. dentata* is very similar to *P. fodiens,* and sharply different from *Diaglena* Cope and *Triprion* Cope (Peters, 1955, Nat. Hist. Misc., Chicago Acad. Sci., 143: 3) both of which genera possess strongly hypertrophied labial flanges. Obviously this cranial character is of greater reliability for generic diagnosis than is the nature of the palatal teeth, heretofore regarded as generically limited. The species *P. dentata* possesses both parasphenoid and palatal "teeth," like *Diaglena* and *Triprion,* whereas *P. fodiens* lacks them.

The intermediacy of *P. dentata* between *P. fodiens* (despite the much closer approach to the latter species) and the bizarre genera *Diaglena* and *Triprion,* in both dental and labial characters, emphasizes the possibility that the two specialized genera may indeed have evolved from progenitors similar to *Pternohyla.* If this were the case, the relationships (*fide* Peters, *op. cit.*) with other genera would best be expressed as

Pternohyla–Diaglena–Triprion–Tetraprion Stejneger and Test, the most highly specialized species occurring toward the south, the least specialized toward the north. It seems clear, as stated by Peters, that there is little relationship between *Anotheca* Smith and the present group of casque-headed hylids.

Range. Apparently the range of *P. dentata* is limited to the upper parts of the drainage system of the Río Verde on the plateau of northern Jalisco and possibly Guanajuato and Aguascalientes. The species almost certainly does not occur as far toward the coast as Guadalajara, where *P. fodiens* is known and where much collecting should have revealed the existence of *P. dentata* if it occurs there. The apparent restriction of the species to such a narrow zone is surprising for although some other hylids are known from but a single locality in Mexico none of this group is so narrowly restricted in range, and the congener *P. fodiens* is particularly widely distributed. Quite possibly the species occurs in areas of the Río Santiago system to the west of the present locality (as for example in the valleys of the Río Bolaños and Río Juchipila), but it seems unlikely that it occurs in parts farther east or south (*e.g.* Guanajuato, Michoacán, México) on the plateau where much collecting should have revealed its presence if it existed there. That the range is restricted to areas of Pacific drainage seems highly likely, and because of probable competition with *P. fodiens* at lower levels it also seems likely that *P. dentata* is limited to regions of higher elevations where apparently *P. fodiens* does not exist, and thus in effect, to areas well within the main Mexican plateau.

Habits and Habitat. Field notes generously supplied by the collectors record that "this specimen was taken from a temporary roadside pond in the high plateau country northeast of Lagos de Moreno. This region is a short-grass plain with scattered xeric shrubs. The temporary ponds were in short grass with no shrubs in the immediate vicinity." In life, as recalled after four months, the background color was an olive drab with scattered reddish brown spots. When the frog was picked up it seemed to inflate the whole body, whereas *P. fodiens* collected in large series elsewhere did not exhibit this response. Rain was falling when the specimen was found, at about 11:00 p.m. Associated species were *Rana pipiens* Schreber, *Hypopachus ovis* Taylor, *Spea hammondi multiplicata* (Cope), *Bufo c. compactilis* Wiegmann, and *Hyla eximia* Baird. According to Smith and Taylor (1948, Bull. U.S. Nat. Mus., 194: 83) the latter species has not previously been reported in the state of Jalisco. All these species, except the first two, give clear evidence of the relationship to the plateau fauna, whereas *Hypopachus ovis* may, like *P. dentata,* be considered to represent the more coastal or plateau-edge element in the local fauna about Lagos de Moreno.

MUSEUM OF NATURAL HISTORY AND DEPARTMENT OF ZOOLOGY, UNIVERSITY OF ILLINOIS, URBANA.

A New Xantusia From Southeastern Utah

By WILMER W. TANNER

On occasion collectors are rewarded for their efforts by finding a species in an area where it is not expected. Such an exciting experience occurred on June 10, 1954, when three specimens of the genus *Xantusia* were taken by my son Lynn and me in North Wash, eastern Garfield County, Utah.

Finding this genus at least two hundred miles northeast of its known range in extreme southwestern Washington County, Utah, is in itself of considerable significance. However, these lizards were larger and differently colored than those seen previously and it was suspected immediately that they represented a new form. Subsequent comparisons with *X. vigilis* Baird and *X. arizonae* Klauber have substantiated their distinctness, and I propose that they be known as

Xantusia vigilis utahensis subsp. nov.
Utah Night Lizard

Type. Brigham Young University No. 11733, collected approximately 20 miles northwest of Hite in North Wash, Garfield County, Utah, June 10, 1954, by Wilmer W. Tanner and W. Lynn Tanner.

Paratypes. Brigham Young University Nos. 11731-32, topotypes; BYU 12644-7 and 13238, 200 yards south of Trachyte Creek, east of road, Garfield County, Utah.

Diagnosis. A subspecies of *Xantusia* similar to *X. v. vigilis* in having the same number of ventrals, dorsals, and scale rows, but differing in the following characteristics: larger size (snout-vent to 50.5 mm.); proportionately longer legs, hind legs 38-40% of snout vent length; lamellae on 4th finger and 4th toe more numerous, 16-19 and 23-25, respectively. There are more gulars and supratemporals than in other *Xantusia,* and the striking buff color is unique.

Description of the type. An adult female with a snout-vent length of 50.5 mm*, tail in the process of regeneration 25 scales posterior to vent. Body wider than deep; tail round, except for base; top of head flat posterior to frontal, somewhat rounded and tapering anterior to snout. Head width 7.3, head depth 4.8, ratio of head width to depth, 1.52; diameter of orbit 1.8; orbit to nostril 3.0; orbit to ear 4.4; length of head plates 10.4; length of 4th toe 6.1; ratio of head plates to length of 4th toe 1.71; length of front leg 12.8; length of hind leg 18.5; hind leg approximately 38.5 percent of snout vent length. Adpressed front limbs reaching to 18th ventral; adpressed hind limbs to 13th ventral; limbs overlapping for a distance of 6 ventral plates.

Rostral fifty percent wider than high, and followed by a series of dorsal head plates normal for the species. Nostril at juncture of nasal,

*All measurements are in millimeters and this one was taken while the specimen was pliable.

internasal, rostral and first supralabial; nasal barely in contact with frontonasal and followed by two loreals, second larger; anterior loreal in contact with frontonasal, prefrontal, and second labial; posterior loreal in contact with first superciliary, prefrontals, third labial and the two anterior preoculars; two latter higher than long and followed by three narrow preoculars on edge of orbit. A series of 5-6 superciliaries and three suboculars extending from preoculars to postoculars; three postoculars, middle largest; an azygous scale on the left side between the second and third superciliaries, and frontal and the frontoparietal. A series of nine supratemporals extending from posterolateral edge of frontoparietal, between superciliaries and parietal, and along lateral edge of latter and occipital; anterior supratemporals of nearly equal size; scale partly wedged between occipital and parietal only a little larger than other supratemporals. Twelve rows of smaller temporals between middle postocular and ear; anterior margin of ear with a series of nine lobate scales; supralabials 8-9, first slightly largest, fifth and sixth below eye; mental as wide as rostral and longer than first infralabial; six enlarged postmentals, second largest, last smallest, series extending posterior to enlarged infralabials, first pair in contact, second pair separated anteriorly by one and posteriorly by two gulars; a series of 39 transverse rows of gulars between first postmentals and enlarged scales of gular fold; seven enlarged scales on gular fold; two pregular folds, 15 scales between them and four rows (including enlarged row) from gular fold to posterior pregular fold; scales in folds noticeably smaller than other gulars, first pregular fold extending from

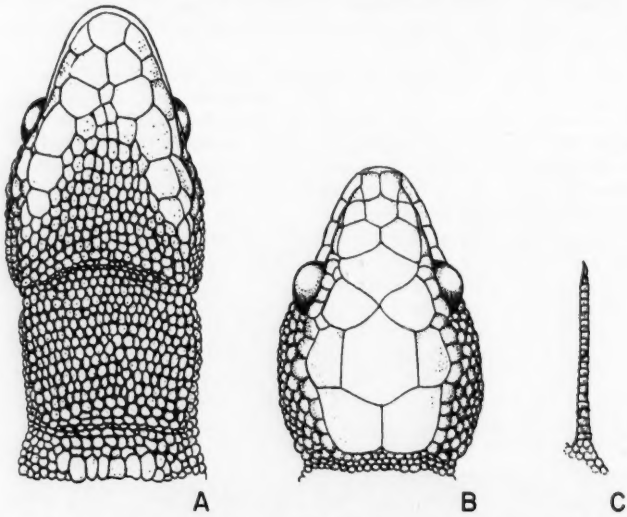

Plate 1. *Xantusia vigilis utahensis* subsp. nov. BYU 11733, 5X. A, ventral view of head and neck; B, dorsal view of head; C, fourth toe showing lamellae.

ear to ear.

Body scales (excepting ventral plates) small, beadlike on neck and becoming conical on body; a series of 37 longitudinal dorsal scale rows at mid-body; dorsals in 106 transverse rows counted between occipitals and base of tail. Ventrals enlarged, rectangular scutes in a series of 12 transverse rows and 30 longitudinal rows, lateral rows smallest and rounded; ventrals followed by two pairs of preanal scales; lamellae fourth fingers 17-17, fourth toes 23-24; femoral pores 10-10.

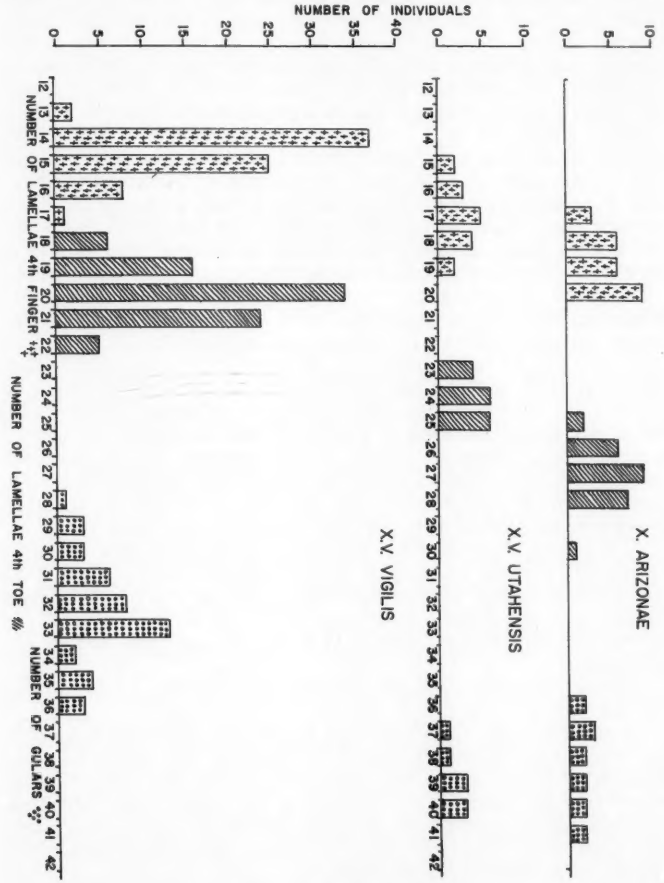

Plate 2. Comparison of the lamellae on the fourth toes and fourth fingers and of the gulars as they occur in *Xantusia v. vigilis, Xantusia v. utahensis* and *Xantusia arizonae*.

Scales in axillary region small; leg scales of about same size as body scales except for patches of enlarged imbricate scales on anteroventral surface of both front and hind limbs. Tail subconical and covered with 46 rings of rectangular scales; tenth ring caudad to vent with 30 scales; posterior to nineteenth ring the tail apparently regenerated.

Color pattern of type before preserving. Dorsal region of neck and shoulders Orange-Buff* with small patches having a more intense color; lateral and posterior to shoulders a lightening to Pale Orange-Yellow; ventral portions of throat, trunk and anterior venter of tail Picric Yellow. Head plates with some orange and buff, heavily blended with yellow. Dorsum of head, trunk and tail punctuated with small dark brown dots; no scales covered by a single dot; venter, without magnification, appearing immaculate. Preservative fluids have quickly removed the buff, orange, and yellow colors, leaving the dorsum a grayish background with scattered irregular patches of dots which have the appearance of small spots. Under magnification such "spots" are actually numerous small, irregular dots on the scales of such areas. One scale may have up to thirty-five dots, and there may be one or two and rarely three adjoining scales with so many dots. There are intervening scales with fewer dots and a very few without them. Laterally the punctuation becomes finer, and is all but absent on the median ventral plates. Tail scales are similarly marked.

Variation. In general the specimens of the type series show a close similarity; however, the following variations are significant: lamellae fourth fingers 16-(17.1)-19, fourth toes 23-(24)-25; femoral pores 7-(9)-10; ratio of head width to depth 1.52-(1.54)-1.58; ratio of head plates (snout to posterior edge of occipital) to length of 4th toe 1.71-(1.76)-1.83; adpressed limbs overlapping for a distance of 6-8 ventral plates; 8 or 9 enlarged scales on gular fold; hind leg length 38.5-(39.5)-41.0 percent of snout-vent length. In all topotypes the frontoparietals are separated by a contact between the frontal and parietal plates. The color pattern is similar in all, but the dots are smaller in the type, giving it a much lighter color since the buffs and yellows have faded.

Comparative Material. The material used came from the following institutions: Chicago Academy of Science (ChAS); University of Utah (UU); Dixie College (DC); University of Illinois (UI); and Brigham Young University (BYU). I am grateful for the loans of material and for the criticisms and suggestions made by my colleagues and by Dr. Jay Savage.

Xantusia arizonae: Arizona, Yavapai Co., Yarnell, ChAS 3351-3, 3375-84.

Xantusia v. vigilis: California, Los Angeles Co., UI 24605 and 30271. San Benito Co., Panoche Valley, BYU 8840-44. San Bernardino Co., Baker, BYU 11773; Cajon Pass BYU 2733, 3030-1 and 3025, UU two unnumbered specimens. *Utah.* Washington Co., near Castle Cliff Rock, UU 2812 and an unnumbered specimen, DC 39; 8 miles west of Castle Cliff Rock, BYU 11205-13; 12648-50, 12676, 12934-45, 12987, 12989 and DC, three unnumbered specimens.

Comparisons. At first *utahensis* was thought to be closely related to *arizonae*. However, there is greater similarity in habitus, color pattern

*Color term capitalized are from Ridgway (1912).

TABLE I

CHARACTERS	*v. vigilis*	*v. utahensis*	*arizonae*
Maximum size	49.5	50.5	57
Ratio head width to depth	1.32-1.58	1.52-1.58	1.48-1.78
Ratio of length of plated head section to length of fourth toe	1.57-2.07	1.71-1.83	1.26-1.32
Ventral scales reached by adpressed fore limb	13-17	16-19	16-21
Ventral scales reached by adpressed hind limb	11-17	9-13	4-9
Ventral scales overlapped by adpressed fore and hind limbs	0-5	6-8	9-17
Hind leg/snout vent length	37-40	38.5-41	37-45
Lamellae 4th finger	13-16	15-19	17-20
Lamellae 4th toe	17-22	23-25	25-30
Transverse rows of ventrals	25-31	29-30	28-32
Enlarged scales on gular fold	4-8	8-9	4-9
Femoral pores	4-10	7-10	11-13
Transverse gulars	30-36	37-40	36-41
Longitudinal gulars between ears	23-29	27-30	28-31
Supratemporals	6-9	8-10	7-9
Color pattern and colors: *vigilis* spotted (variable) cream to brown, some yellow; *utahensis* small spots, yellows and buff colors; *arizonae* large spots.			

and in most of the scale formulae between *v. vigilis* and *v. utahensis*. These relationships are more clearly seen in Table I. Plate II shows the intermediate position of *v. utahensis* when compared with *v. vigilis* and *arizonae*.

X. *utahensis* is larger, with proportionately longer legs, more lamellae under the fourth fingers and toes, and with more transverse rows of gulars than in typical *vigilis*. Furthermore, *utahensis* is at the limits for the species in the number of transverse ventrals (30), in the ratio of hind leg to snout-vent lengths (38-41) and in the number and size of the supratemporals. In color pattern the reddish-buff is unique for *vigilis* if not for the entire genus.

A large series of *vigilis* from near the type locality has not been available. However, those at hand represent three widely separated localities: extreme southwestern Washington County, Utah; near Cajon Pass, San Bernardino County; and Panoche Valley, San Benito County, California (latter site described by Christenson, 1948: Herpetologica, 4:228). From the first locality the specimens average smaller, ranging from 21.5-38 mm. snout to vent. The ratio of head plates to length of fourth toe is considerably higher than reported by Klauber (1931, Trans. San Diego Soc. Nat. Hist., 7:1-16), ranging from 1.9-2.2, with the young specimens having a higher ratio than the adults. Specimens from San Bernardino County range up to 46 mm., are more heavily pigmented, and have a reduced number of transverse ventral rows (27-29). The specimens from San Benito County are of approximately the same size as those from southwestern Utah and are more heavily pigmented than individuals of either of the other series, and have a distinct and noticeable

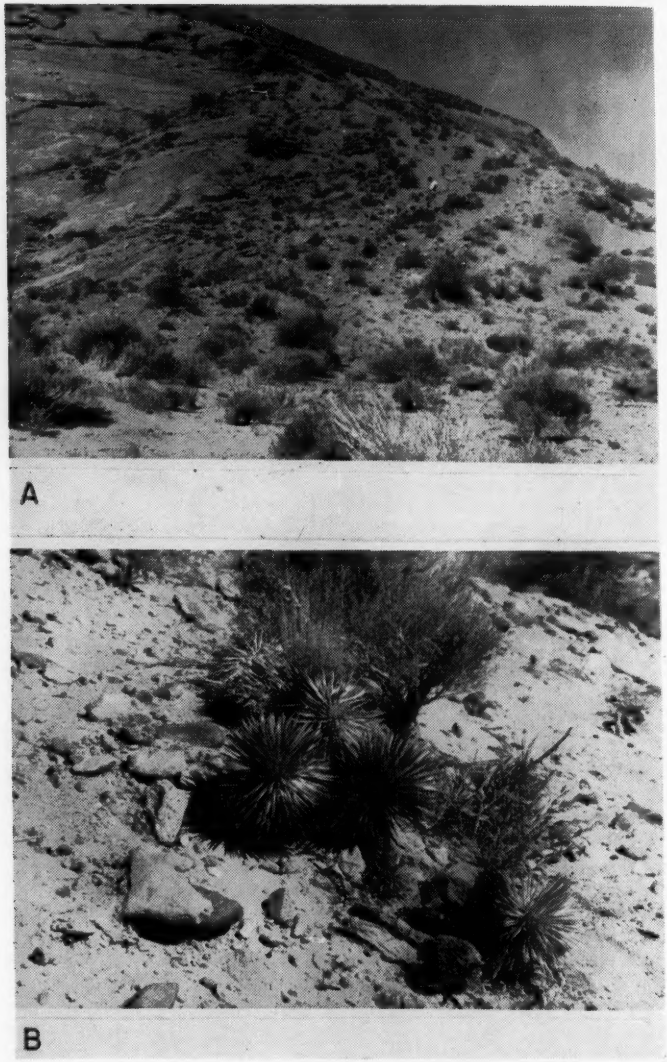

Plate 3. Type locality of *Xantusia v. utahensis,* approximately 20 miles northwest of Hite, Garfield County, Utah. A, showing the author at the spot where the type specimen was taken; B, the cluster of *Yucca angustissima* Engl. in which the type of *Xantusia v. utahensis* was found.

dorsolateral light stripe extending from the posterior superciliary along the upper edge of the supratemporals and the enlarged head plates across the nape to near the shoulder region. These stripes are perhaps more noticeable because of the heavy pigment which produces a greater contrast. In many specimens from southwestern Utah it is difficult to recognize these lines, and when present they do not extend beyond the enlarged head plates. Also there is an increase in the transverse ventrals (30-32) and in the transverse gulars (35-36) in the series from San Benito County.

It is seemingly evident that there are a number of sub-populations within the subspecies *vigilis vigilis* as it is now constituted. Whether these will prove to be sufficiently variable to warrant additional subspecies must await the studies being carried forward by Dr. Jay Savage.

Ecology and Habitat. The area betwen the Henry Mountains and the Colorado River is rugged and crossed by many gorges that have cut deeply into the plateau. Actually the distance from the summit of Mt. Hillers to the Colorado River at Hite is only about 18 air miles, yet there is a difference of over 7,000 feet in elevation. Much of the plateau around the Henry Mountains is composed of sandstone which has disintegrated into much loose sand. Some of these areas have small but active sand dunes, which are made more active during periods of drought and, in most of the area, because of overgrazing. Fortunately there are many plants in this area which are adapted to sandy soils and which have held the loose sand together. One of these is the low-growing *Yucca.* I have seen species of this genus in the eastern parts of Kane, Garfield, Wayne, and Emery counties and suspect that the night lizard may occupy much of the same terrain.

Although I have seen and collected many Xantusiids from the fallen branches of the Joshua Tree(*Clistoyucca brevifolia*), it had not occurred to me that they might also be found in the *Yucca* species of Utah. Quite by accident the new form was found while we were digging up a large clump, which was partly covered with sand, in the hope of finding some snake which had taken refuge in the protected lower rosette of leaves. The yellowish, rust-stained lower leaves provided an environment ideally suited for the blending of colors. Thus we found it most difficult to see the lizards and were forced to remove the leaves a few at a time.

In two hours we were able to see and collect only three lizards. One week later, June 17-20, we spent three more days in the same area without seeing another *Xantusia.* By this date the temperatures were high and the area was extremely dry. According to Miller (1951, Copeia, 2:114-120,) high temperatures in open areas (35-42 C.) affect the habits of this lizard, causing it to seek more shaded areas.

BRIGHAM YOUNG UNIV., PROVO, UTAH

ANOTHER UNICOLOR MANY-LINED SKINK FROM NEBRASKA.—A lineless specimen (see Fig. 1) of *Eumeces multivirgatus* (Hallowell) was secured April 20, 1956, by the senior author near a dump 1½ miles north of Arthur, Arthur Co., Nebraska. It is an adult measuring 65 mm. in snout-vent length and with a regenerated tail. In scutellation it agrees with others of the species, having a postnasal on both sides, 1-2 postlabials, 2 postmentals, and 25 scale rows. The limbs are short, the foreleg measuring 13 mm., the hind leg 15.5 mm., the axilla-groin distance 41 mm., and the snout-foreleg distance 17 mm. The dorsal color is a very pale clay-brown, the scales narrowly edged with a slightly darker shade especially in the nuchal region and on the sides. The lips and ventral surfaces of body are a very pale bluish white, unmarked. There is no clear evidence of light stripes, although the 3rd scale row on each side of neck and shoulder is faintly lighter than adjacent rows; on the sides of the back is a similar faint light effect along the 4th, 5th and 6th scale rows. There is also a slightly greater pigmentation along the adjacent edges of the scales in the 4th and 5th scale rows and in the 5th and 6th scale rows. The regional variation in pigmentation is so slight, however, that the total effect is of a unicolored, totally stripeless animal only slightly darker along the sides than on the back. The general tone is remarkably like that of the plate of *Eumeces humilis* Boulenger (=*E. taylori* Smith) in Taylor's *Eumeces* monograph (1936, Univ. Kansas Sci. Bull., 23: 601, fig. 1). (All the above description is based upon the live specimen, now Univ. Ill. Mus. Nat. Hist. No. 40696).

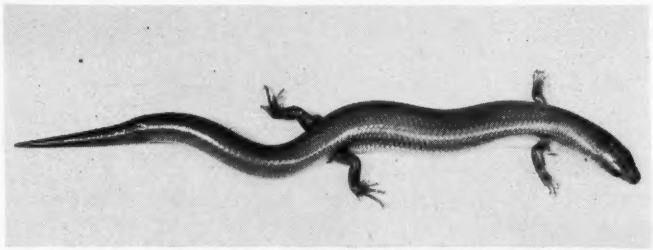

Fig. 1. A lineless *Eumeces multivirgatus* from 1½ mi. N. Arthur, Arthur Co., Nebraska.

The locality of capture is not of special interest, for the species is known from scattered localities that well encircle Arthur (Hudson, 1942, Nebr. Cons. Bull., 24: 43). The patternless condition, however, has rarely been recorded previously in *E. multivirgatus*, although it occurs invariably in the sympatric form known as *E. taylori* Smith of the Guadalupe Mountains of southeastern New Mexico and adjacent Texas. As pointed out by Lowe (1955, Herpetologica, 11: 233-5), no structural differences are known between *E. multivirgatus* and *E. taylori;* they seemingly differ solely in pattern, and Lowe concludes that they are conspecific. Stripeless specimens have been recorded only from the range of *"taylori,"* and from certain other scattered regions in the range

of *E. multivirgatus* as indicated by a few old specimens some of which are either certainly or possibly discolored by preservation. Among these old specimens are the types of *E. inornatus* (Baird) from the "Sand Hills of the Platte," and one of the cotypes of *E. epipleurotis* Cope from the "Northern boundary of Texas." The present specimen from Arthur strongly suggests that the types of *E. inornatus* were patternless even in life, and Dr. E. H. Taylor has kindly advised (in correspondence) that within the past year or so he has seen a specimen "from the Texas panhandle . . . that conformed in all details with Cope's *epipleurotis*." It was not possible to ascertain further information about the latter specimen.

The known occurrence of patternless specimens in three different regions is of considerable importance. The senior author has secured typical *E. multivirgatus* at numerous times in the vicinity of Arthur, where both patternless and patterned specimens may be assumed to occur side by side. Likewise both *"taylori"* and typical striped *E. multivirgatus* occur in the Guadalupe Mountains, where a three-lined form known as *E. gaigei* Taylor also occurs. Any one of three taxonomic arrangements would be admissible under these circumstances, assuming that microsympatry as well as macrosympatry of the striped and unicolor forms occurs: (1) that the lineless pattern is a variant of the more frequently occurring lined pattern, both patterns occurring in individuals of a single taxonomic population; (2) that the lineless specimens represent a single species, distinct from *E. multivirgatus*, of discontinuous distribution; or (3) that the three lineless populations represent distinct species that in turn are distinct from *multivirgatus*. The second alternative would require use of the older name *E. inornatus* for all lineless populations, whereas, if the third alternative is correct, both names *E. inornatus* and *E. taylori* would be preserved.

In point of fact, however, it now seems highly improbable that either the second or the third alternative is correct. The only conclusive proof would come with an analysis of breeding behavior and/or of clutches of young in areas where both lined and lineless phases occur. In the absence of such evidence the most reasonable conclusion is that the two pattern types represent color phases of single populations. In view of the apparent microsympatry of both phases in all areas from which they are known, they cannot reasonably be regarded at present as representing different subspecies. The situation remains peculiar, however, for lineless specimens (a) apparently do not occur everywhere or even in any broad area in the range of the lined form, and (b) they seemingly do not occur with the same frequency at the three localities whence they are known. With the scant material now available it is futile to speculate on the possible significance of the irregularity of distribution of the lineless specimens, for the nature of the irregularity itself is far from clear; it seems highly likely that lineless specimens occur at many more localities than these now known. The picture is complicated by the occasional occurrence of other pattern variants especially in the southwestern part of the range of *E. multivirgatus* but to a lesser degree elsewhere also. Taylor (*op. cit.*: 349) mentioned dim-lined specimens from Nebraska, Chihuahua, and Lincoln Co., New Mexico; he also

records three-lined specimens from Grand Canyon, and the three-lined *Eumeces gaigei* from New Mexico and Texas has been interpreted by various authors as a variant of *E. multivirgatus*.

Some miscellaneous observations on the activity and behavior of the skink were made during the five months (April through September) it was kept by the senior author. Unfortunately circumstances prevented regular observations. At the time of capture the skink had evidently just lost part of its tail. Regeneration was slow at first but at the end of the five months regrowth of the tail was nearly completed. The unicolored specimen was kept with a typical manylined skink in a glass aquarium which had a basal area of approximately 500 square inches. Sandy soil covered the bottom to a depth of about four inches. The skinks made a number of burrows in which they spent most of their time without evidence of territoriality. Although they would come out at any time of the day they appeared most active during early to mid-morning and during the latter part of the afternoon. There was no evidence of nocturnal activity. Two methods of enticing the lizards to the surface became apparent. If they hadn't been fed recently, the movement of a fresh supply of grasshoppers above their burrows usually brought them out into action. Simulated rain in the form of water sprinkled on the soil often brought the skinks to the surface where they seemed to enjoy the cooling effect. It was doubted that the sprinkling drove them out since the moisture seldom penetrated the soil more than half an inch. Small grasshoppers (¼ to ¾ inch in length) proved to be a desirable food item since they were easy to obtain and the skinks readily ate them. They made up nearly all of the diet. Small crickets and houseflies were taken when offered but ants and small beetles were usually refused. Small mealworms were not accepted, curiously enough, but acorn worms were eaten avidly. It was impossible to feed the animals regularly but it appeared that one to two grasshoppers of the size mentioned above might be consumed daily. Water was kept in the confine in a dish where the skinks occasionally lapped it. After five months in captivity both skinks appeared in excellent condition.—*Daniel H. Heyl, Box 243X, R.F.D. 1, Bellefonte, Pennsylvania, and Hobart M. Smith, Museum of Natural History, University of Illinois, Urbana.*

THE WESTERN PATCH-NOSED SNAKE IN CENTRAL NEW MEXICO.—A western patch-nosed snake, *Salvadora hexalepis deserticola* Schmidt, was obtained 7.8 miles west of Magdalena, Socorro County, New Mexico, on June 30, 1956. The specimen is 792 mm. in total length. The snout-vent length is 546 mm. All of the key characters, the single loreal reached by the third and fourth of the nine upper labials and the three small scales between the posterior chin shields, fit the typical *S. h. deserticola.* There are 200 ventral and 72 caudal plates. Scale row counts are 17-17-15. The western patchnose snake has previously been known in New Mexico only from the southwestern corner. This record extends the known range of the subspecies approximately 100 miles north.—*David L. Jameson, Department of Biology, University of Oregon, Eugene, Oregon.*

A New Species of *Phrynohyas* From Nayarit

By FREDERICK A. SHANNON and FRANCES L. HUMPHREY

During the course of a trip to Nayarit, Mexico, in the first part of August, 1956, the authors secured a representative of a new species of *Phrynohyas* from the dense neotropical coastal jungles just east of San Blas, Nayarit. The individual was taken on a paved road about 9:00 P.M. No temperatures were recorded at the time, but little change was apparent four hours later when an air temperature of 27° C. was secured at a nearby locality. There had been no heavy rains for the preceding four days, but erratic scattered showers had occurred on this and on most of the previous days. Intensive collecting failed to uncover additional individuals.

*Phrynohyas corasterias** sp. nov.

Holotype. F.A.S. No. 11307, a young adult female from 4.8 miles east of San Blas, Nayarit, collected by Frances L. Humphrey and Frederick A. Shannon on August 11, 1956.

Diagnosis. The present species is related to *P. inflata* Taylor and *P. latifasciata* Duellman, but is the most distinctive species in the *inflata* group. From *latifasciata, corasterias* differs in the possession of the following: (1) less webbing on the foot (only the third and fifth toes are fully webbed in contrast to the first, second, third, and fifth of *latifasciata,* although a wide flange may be present on other toes); (2) well developed pustules over entire dorsum (largely lacking in *latifasciata*); (3) a tarsal fold; (4) a large bifid subarticular tubercle on penultimate joint of fourth toe; and (5) marked color differences on the back and tibia. *P. corasterias* differs from *inflata* in (1) its lesser extent of foot webbing; (2) its poorly developed or absent supratympanal fold (heavy in *inflata*); (3) having a more pustular dorsum; and (4) the marked differences in dorsal pattern, color, and nature of antebrachial banding.

Description of the holotype. Dorsum of head slightly more pustular than dorsum of body; head slightly wider than long; canthus rounded to the point of extinction; loreal region slightly concave; snout rounded; interorbital space same as that between nostrils; diameter of eye greater than distance between nostril and eye; tympanum distinct, subcircular, with diameter slightly greater than distance between tympanum and eye; supratympanic fold quite indistinct.

Tongue broader than wide, subcircular, entire or but slightly notched behind, free for posterior 1/3; choanae fairly large, hidden. Vomerine teeth in two nearly linear patches situated on a line between anterior margins of choanae, with each patch separated by a distance slightly less than length of individual patch and separated from choanae by a distance greater than length of patch. Maxillary teeth bifurcate.

Back fairly smooth between pustules; pustules numerous, wide, flattened; dorsal surfaces of antebrachium and tibia quite pustular, those of brachium and thigh much less so; anus transverse, slightly above postfemoral midline.

*From the Greek for "star-like pupil."

Thenar eminence elongate, flattened; palmar tubercle small, round; hypothenar eminence same size as palmar, followed by three slightly smaller tubercles and terminating in a third, high, sharp subarticular tubercle beneath metacarpophalangeal joint; numerous other palmar tubercles; subarticular tubercles single, round, distinct; fourth penultimate subarticular tubercle heart-shaped, bifid; digital formula, 3-4-2-1; finger discs distinct, about size of tympanum. First web vestigal; second and third webs pronounced, about 1/3 length of second and fourth toes respectively.

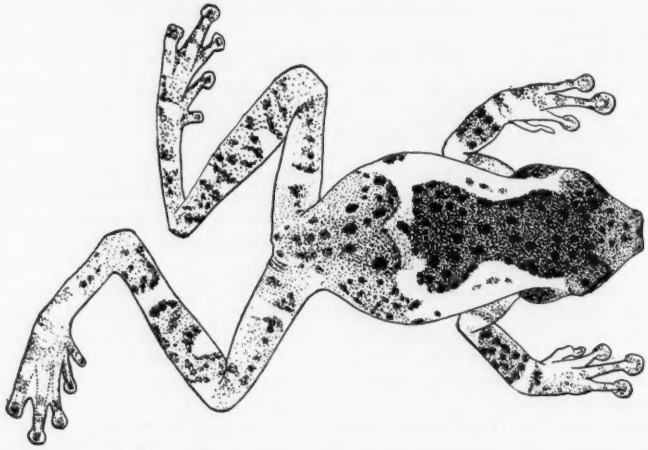

Fig. 1. *Phrynohyas coriasterias,* holotype (F.A.S. No. 11307), a young adult female.

Tibiotarsal joint extending to eye; adpressed tibiotarsal joints overlapping slightly; tarsal fold elongate, flat, extending from metatarsal tubercle to tibiotarsal joint; medial metatarsal tubercle flat, fairly distinct; lateral metatarsal tubercle apparently absent; metatarsal surfaces pustular; subarticular tubercles distinct, round; toe discs distinct, rounded, slightly smaller than those on fingers; digital formula, 4-5-3-2-1; third and fifth toes subequal in length; third and fifth toes webbed to discs, first and second toes ¾ webbed.

Chest smooth; gular region somewhat crenulate; abdominal surfaces pebbly, becoming coarsely so over ventral surfaces of thighs.

Measurements of holotype in millimeters. Snout-vent, 34.4; head width, 12.6; head length, 10.75; interorbital distance, 3.25; diameter of eye, 3.6; nostril-eye, 3.25; eye-snout, 5.7; eye-tympanum, 2.0; nostril-snout, 1.4; internasal, 3.35; diameter of tympanum, 2.25; femur, 15.5; tibia, 16.0; foot, 22.2; third finger pad, 1.4; third finger at narrowest portion, 1.0; fifth toe pad, 1.3.

Color of holotype in life. Head olive green to between eyes; dark, hourglass-shaped spot covering most of head and extending to middle of body, circumscribed by U-shaped cream colored mark terminating on eyelids and extending laterally and posteriorly onto venter at middle of body; occasional indistinct darkish pustules on dorsal arms of "U;" large olive-green spot, slightly paler than head, covering posterior portion of body; legs transversely banded with pale olive green to cream; hands and feet pale green, irregularly banded with light; eye golden with pupil in shape of a cross; upper lip pale green; venter immaculate, light.

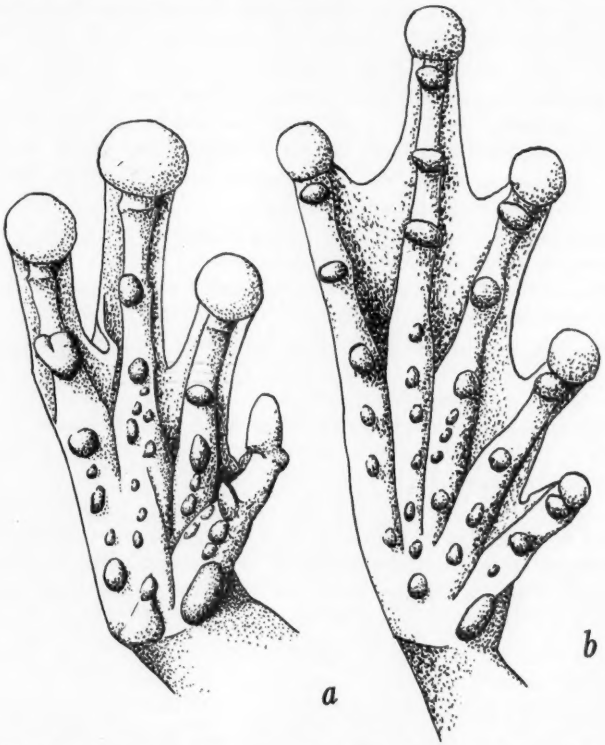

Fig. 2. Phrynohyas corasterias, holotype (F.A.S. No. 11307), (a) right hand, (b) right foot.

In alcohol, the large anterior blotch rich brown, spotted by the broad, black pustules; hourglass-shaped ground color area white, with occasional small dark contrasting spots evident; large posterior blotch light greenish-gray, liberally sprinkled with the dark pustules; antebrachium covered by a broad transverse blotch, narrowly and sharply bordered with white on elbow and wrist; brachium similarly marked; anterior dorsal

surfaces of thighs with two light, transverse marks also distinctly set off by narrow white bands; dorsal tibial surfaces and feet similarly marked; posterior surfaces of thighs nearly uniform cream; chest and gular regions white; abdominal surfaces translucent.

Comparisons. The relationships of *corasterias* to *latifasciata* and *inflata* are evident from the general configuration of the body patterns in the three species as well as from the presence in all three of a cruciate dark pupil in life. This character is lost in preservation, when the pupil appears round with a white, opaque lens. According to Taylor (1944, Univ. Kans. Sci. Bull., 30:66) and Duellman (1956, Misc. Publ. Mus. Zool. Univ. Michigan, 96:20) the ground color of *inflata* is reddish brown with dark dorsal blotches, contrasted to a pale olive posterior blotch on a cream or white ground color in *corasterias*. Duellman (*op. cit.*: 25) records the ground color of *latifasciata* as a pinkish-buff with chestnut brown dorsal blotches. In contrast to the large uniform color area covering the back of *corasterias*, the anterior blotch of *latifasciata* is reduced to scattered spots; the dark patches on *inflata* may be irregularly connected. *P. corasterias* further differs from *P. inflata* in having wider dark transverse arm bands, the correspondingly narrower interspaces in the former being lighter in color. The arm and leg bands of *corasterias* are more nearly like those of *latifasciata* in general configuration. *P. latifasciata* lacks the bifid subarticular tubercle on the fourth finger.

Too much significance should not be attached to the extent of webbing on the foot of *corasterias*, as the only known individual is a young female. Large males may be more fully webbed.

The characters of *corasterias* do not appear to be intermediate or clinal between those of *latifasciata* to the north and *inflata* to the south. While the species resembles *latifasciata* in the configuration of leg banding and *inflata* in the presence of the bifid tubercle and dorsal postulation, the likelihood of *corasterias* being an interspecific hybrid is remote, as the white ground color is a character common to neither of the other species.

Remarks. Nothing is known about the habitat of *latifasciata*, but the thorn forest at its type locality at Presidio near Mazatlán, Sinaloa, is not like the liana-filled deciduous forest near San Blas. The type of *inflata* was taken from "scant forest."

A sticky, liberal exudate was responsible for vasomotor rhinitis in both collectors.

We are grateful to Ellen C. Shannon for the illustration and for certain criticisms.

WICKENBURG, ARIZONA

Notes on Diseases and Mortality in Testudines

By TIMOTHY J. HUNT

Little attention has been given to the diseases and causes of death in the Testudines or in other orders of reptiles. The present contribution is based upon over 200 autopsies and the published literature. It was found that the Testudines, like most other reptiles, decompose at a rapid rate after death, and that therefore only prompt autopsy permitted satisfactory analysis of cause of death. A summary of all deaths, from the literature and autopsies, is given in Table 1.

Injuries and Accidents. Contrary to popular assumption, terrapins and other aquatic species of Testudines are susceptible to drowning much as other animals are. There are no available records of marine turtles being drowned but many have been washed ashore and seldom, if ever, has the cause of death been determined. Members of the genera *Chelydra, Kinosternon, Clemmys, Emys, Cycloderma* and *Testudo* have had their deaths attributed to drowning.

One death has also been recorded of *Emys orbicularis* by electrocution.

A large percentage of deaths result from fractures of the shell, particularly the plastron. In aquatic species the possibilities of regeneration are considerably less than in terrestrial species, for excessive damage to the epidermal laminae of the former leads to necrosis of the underlying bone. The degree of damage to the epidermal laminae in terrestrial species appears to have no relation to the degree of regeneration.

Although early observations suggested that the epidermal laminae seldom grow again after injury, Danini (1946) in his concise work on the regeneration process in *Emys orbicularis* showed that the regenerated epidermis is, after four months, thicker than the surrounding original epidermis. Tension in the area of the wound results in the new bone considerably altering the pattern of the bony plates surrounding the wound. This mechanical stress may even cause excessive bending of the plates in the immediate vicinity of the wound, as has been noted by the present author in terrestrial species. Danini records that the bone defect is not filled up by regeneration. The present author feels that, in view of the number of specimens examined by him in which regeneration of the bone has been complete, further work must be undertaken on this problem before any conclusive opinion may be given. The governing factor is not, as was supposed by Gadow (1901), the amount of damage to the Malpighian cells but is, more probably, whether or not a necrotic infection invades the wound. It is thought by the present author that the extent of necrosis is dependent on the habits of the individual species, and particularly upon the type of water inhabited.

Gadow attributes the origin of the trivial name in the specific name *Clemmys leprosa* to the eroded appearance of this turtle due to fungus invasion. A secondary bacterial infection usually follows the invasion and causes the ultimate death of the animal in penetrating the peritoneal wall.

Inanition. This physical condition, resulting from complete lack of food, is of common occurrence particularly in terrestrial species and in others which may hibernate. In captivity this condition is usually in-

duced by psychological disturbance or by maintenance of temperatures lower than those required for comfortable ingestion of food. Severe anemia usually accompanies this condition, and even where hemal parasites are discovered the anemia may be regarded as the initial although not the direct cause of death. The upper region of the alimentary canal is usually in a mummified state after prolonged inanition.

Mycosis. Disease directly attributable to fungus infection may be subdivided into groups: those attacking the respiratory system, and those invading the bony and epidermal laminae of the shell. The former usually result in pulmonary mycosis which forms 3 percent of the total number of recorded deaths. The large air vesicles in the lung are filled usually with *Aspergillus,* which results in consolidation and sometimes gangrene of the lungs. Extensive infection may break down the partitions between the air sacs of the lungs. *Aspergillus* pulmonary mycosis is not as common in occurrence in aquatic turtles as in terrestrial species. This disease may be infectious when animals are in close contact with each other as when crowded together during transportation.

Most necrosis of the shell is of mycotic origin. Of those cases which have been recently examined, the author found all were due to the invasion of Mucorales beneath the plates of the epidermal laminae. This disease is of extremely common occurrence and has been found in all members of the order but is seldom found in marine species.

Mycosis more frequently occurs on the plastron than on the carapace. In some species the necrosis seems to confine itself to one area, as in *Sternotherus carinatus carinatus,* whose marginals are commonly heavily infected (Carr, 1953).

Tuberculosis. This disease has been recorded in every order of reptiles, the serpents (in particular the pythons) having the highest mortality rate due to this disease. However, the number of actual recorded cases of tuberculosis in Testudines is comparatively small. In fact the only definite and reliable report of death among turtles from tuberculosis is for two specimens of *Chelydra serpentina.* Other reports are questionable.

It is thought by some that the strains of the acid-fast tubercular bacilli of reptiles and amphibians differ in character and virulence from strains infecting humans and other animals. The insufficient evidence available does not show that tuberculosis is communicable even between different species of reptiles. There is no reason to believe, on the other hand, that reptilian tuberculosis may not be communicated from a sick to a healthy specimen when both are of the same species.

Diseases of the alimentary system. Diseases of the alimentary and respiratory systems constitute nearly seventy-five per cent of the deaths determined and recorded, the mortality rate from the former cause exceeding the latter by a small margin.

The most frequent alimentary disorders are associated with inflammation of the intestine and stomach. Enteritis and gastritis are induced by the action of species of *Entamoeba* commonly found attached to the mucous epithelium. These parasites secrete a cytolytic ferment which destroys the host cells and gradually erodes the surface of the intestinal wall.

Impaction of feces, which results in intestinal obstruction, is also of common occurrence in captivity and has been noted in the wild state with the ingestion of large-sized lumps of foods (Hunt, 1956).

The deposition of fat globules in the liver, resulting in fatty degeneration, is also of frequent occurrence in captivity. The disintegration of liver tissue with the formation of abscess and cirrhosis of the liver is also common.

Diseases of the respiratory system. Congestion and inflammation of the lungs, particularly lobar pneumonia, forms the highest single mortality rate for all species. This large percentage is attributable to the crowded conditions inflicted during transportation for trade purposes (Zool. Soc. London, Council, 1928). Abscess and gangrenous conditions of the lung have been known to occur in the larger members of the genus *Testudo* only.

Diseases of the blood. Recorded diseases of the blood and circulatory system in Testudines are few, but as in all reptiles, anemia is of frequent occurrence. However it is seldom the primary cause of death and is usually due to blood parasites or to heavy infestation of parasites elsewhere. It occurs frequently as a secondary effect of inanition. Atherosclerosis and atherona have been found in senile specimens of the giant species of *Testudo,* and pulmonary hemorrhage has also been recorded thrice but is usually secondary to respiratory parasitic infection.

Blood parasites have been found to be a direct cause of death in terrestrial species only. *Haemoproteus* has been recorded in the majority of terrestrial species whereas *Haemogregarina* is also found in the freshwater species. Neither of these parasites, however, has been recorded in the marine species. *Trypanosoma testudinis* has been recorded in *Testudo esculenta,** and *Nuttalia guglielmi* in *Testudo marginata.*

Septicemia has been recorded in terrestrial species.

Parasites. An analysis of the statistics referring to mortality causes leads to the following conclusions: the marine species are generally more resistant to entozoa than other aquatic species; the aquatic species, which are also generally carnivorous, are affected to a greater extent by entozoa than the terrestrial species which are usually herbivorous; in comparison to the aquatic members of the order, the terrestrial species are infrequent hosts to Trematodes. Most of the entozoan parasites recorded are known from more than one species, and a few stenoxenous forms of Protozoa are recorded from certain host species of turtles.

Robertson (1908) and Reichenow (1910) found that the leech is the vector of two parasites, *Trypanosoma vittatae* and *Haemogregarina stepanowi,* in aquatic species, and similar observations later have provided light on the method of transmission among freshwater turtles. In terrestrial species the vectors are suspected of being ticks, but of this there is no definite evidence.

It is generally noted that the external parasites are less numerous on adolescent and active individuals.

The North American Box-turtles of the genus *Terrapene* have been

*A probable synonym of *Chelonia mydas mydas.*

recorded by Peters (1948) to be a host for dipterous parasites and later Rainey (1953) recorded a death by dipterous larvae.

Members of the Salmonella group of bacteria have been recorded from *Testudo graeca.* The solitary nature of this species suggests that it is a non-pathogenic and expected inhabitant of the Testudine bowel.

Although frequently seen on specimens there are few records of ectoparasites on Testudines. Of particular interest is the tick *Aponomma gervaisi* which is to be found on old specimens of *Testudo elegans* of Ceylon. The coloration of this parasite is identical with that of its host (Deraniyagala, 1939). Recent observations on this parasite by the present author show its apparent ability to darken its colors of yellow and dark brown in order to conform with the gradual darkening of the skin of old specimens of its host.

Diseases of the urinary organs. As in all animals many forms of nephritis — inflammation of the kidneys — contribute greatly to the mortality rate. Although associated with senile animals a few young individuals have also suffered. Hard urate concentrations blocking the urinary channels and the hardening of the kidneys with sclerosis has been recorded only in the terrestrial species of Testudines.

Although it is known that certain species of *Gopherus* and other terrestrial species living in arid areas are able to retain their urine for a considerable length of time without its becoming a toxic solution (Woodbury and Hardy, 1948), retention of urine has been noted to have been the primary cause of death in at least five specimens in captivity representing three terrestrial species.

Table 1. Causes of Death in Turtles

	Aquatic		Terrestrial	Total
	Freshwater	Marine		%
Injuries and accidents	.9	.1	.1	1.1
Inanition	.1	—	.6	.7
Mycosis				
(shell)	.95	—	.05	1.0
(pulmonary)	1.6	—	1.4	3.0
Tuberculosis	.05	—	—	.05
Alimentary system	19.0	.5	20.0	39.5
Respiratory system	15.0	1.0	20.0	36.0
Blood Vascular system	2.9	.1	3.0	6.0
Parasites	4.7	2.0	4.2	10.9
Urinary system	.5	—	.1	.6
Generative system	.2	—	.3	.5
Bone	.19	.2	.26	.65
Totals	46.09	3.9	50.01	100.00

Diseases of the generative organs. The ability of Testudines to retain their eggs for great lengths of time, until a suitable place is located for their deposition, has been found to result, if they are retained for any considerable time, in necrosis of the ova and oviduct. This commonly occurs in all species of the order.

Diseases of the bone. Rickets is of extremely frequent occurrence in young specimens, particularly the freshwater species, death usually occurring as a result of associated enteritis. Laboratory-bred animals are highly susceptible to this disease in early life and although recovery is possible with sufficient attention, distortion of the carapace is particularly evident in later years. Osteomalacia when established, always results in the death of an animal and is usually not obvious until shortly before the acute stages are reached. It is of particular interest to note that occurrence of rickets in marine species of the order is negligible, and that the recorded instances for terrapins inhabiting water with a higher salinity than normal are fewer than for turtles inhabiting water with a lower salinity.

Acknowledgments. The author is greatly indebted to Dr. W. C. Osman Hill and to the staff of the Prosectorium of the Zoological Society of London for their guidance, and to Dr. Annie Porter for her considerable assistance in placing at his disposal her many parasitological findings. The assistance rendered by Dr. Heinz Wermuth and Miss Mary Thompson are also greatly appreciated.

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c/o ZOOL. SOC. LONDON, REGENT'S PARK, LONDON, N.W. 1, ENGLAND

A RECORD OF LONGEVITY FOR THE GREATER FIVE-LINED SKINK.—On May 24, 1952, a large female *Eumeces laticeps* (Schneider) was collected about four miles northwest of Effingham, Charleston Co., Illinois. The specimen measured 97 mm. in snout-vent length, and totally lacked light lines. A lateral dark zone from neck to base of tail was evident but not well defined; even the light lateral line usually persistent below the dark zone was absent. This specimen was kept alive in captivity until December 11, 1956, when it died of natural causes. Several months before its demise it began to eat with less gusto than formerly, and for the final two months it did not eat, although it drank freely. Several attempts were made during these two months to eat, but the food could not be grasped in the mouth.

The degeneration, presumably due to old age, involved at least the lower jaw, the bones of which became rubbery toward the tip, and the cranial scales, which became more strongly convex and crinkled than normal. The lizard may have succumbed to the effects of dietary deficiencies, although it had lived successfully on the same diet throughout the previous years. It was fed mealworms during winter, but during other months was fed a wide variety of local insects, including cicadas, moths, grubs, beetles, grasshoppers, etc.

The age of this lizard upon capture is of course not determinable with much accuracy. The sequence of pattern change described by Fitch (1954, Univ. Kans. Sci. Bull., 8 (1): 9-94) for the related species *Eumeces fasciatus* (Linnaeus) strongly suggests that the specimen was at least four years old when caught, indicated by the large size and almost complete pattern degeneration at the time of capture, and by the failure of further change in pattern or size during its subsequent years in captivity.

Thus it seems a safe assumption that this specimen was at least 8 years old and may well have been 9 or 10 years old when it died. Of *E. fasciatus* Fitch states (*op. cit.*: 141) that "certainly few live more than five years," although he does not venture what the maximum age might be. In a more recent article (Herpetologica,(12: 328, 1956) he provides better evidence than is here given that at least *E. fasciatus* reaches an age of 10 years or more. No records of longevity for *E. laticeps* are known to me.—*Hobart M. Smith, Museum of Natural History and Department of Zoology, Univ. Illinois, Urbana.*

LEAPING ABILITY OF THE GLASS LIZARD.—On September 10, 1956, at 2:00 p.m., I captured a 14 inch specimen of *Ophisaurus*, species undetermined, in a residential area of Hattiesburg, Mississippi. The lizard was making slow progress in crossing smooth asphalt paving. When dropped in grass, it became very much excited in attempting to escape, and several times hurled itself free of the ground to a height of perhaps five or six inches. I have found no previous reference to the ability of this lizard to perform such an act.—*J. William Cliburn, Div. Biol. Sci. Mississippi Southern College, Hattiesburg, Miss.*

Observations on Captive and Wild North American Crocodilians

By CHARLES R. LEBUFF, JR.

Many beliefs popular among both laymen and scientists about the breeding habits of our native crocodilians, *Alligator mississippiensis* (Daudin) and *Crocodylus acutus* Cuvier, have originated largely from folklore. They are thus understandably erroneous to a conspicuous degree, not so much because the folklore is a product of outright fabrication, but because it is based upon casual and misinterpreted observation. Many accounts portray the breeding habits of the alligator as involving a degree of parental care and maternal instinct much above the levels exhibited by most other reptiles, even approaching those typical of mammals and birds. On the contrary, through direct observations of both captive and wild alligators I have come to the conclusion (my own) that the alligator cannot reasonably be regarded to be much if any advanced over other reptiles in care and protection of its eggs and young.

Observations pertinent to the following account were made on captive specimens between August 1, 1953, and September 1, 1956, at the Everglades Wonder Gardens, Bonita Springs, Florida, where the writer was employed for a number of years. Statements concerning wild specimens are based upon field observations made by myself along the banks of the Imperial River and its tributaries in Lee County, Florida, and in sections of the Big Cypress Swamp, including some of its many lakes, ponds and sloughs.

It is a common statement (as for example in Oliver, 1956, Nat. Hist. N. Amer. Amphs. Repts: 229) that "In mating the male alligator seizes the female in his mouth by her neck or the rear of her head." On the contrary, in over two years of observation I have never witnessed such an act between members of the opposite sex, before, during, or after copulation.

As an initiation of sexual activity, from the very late fall (November) until early spring (March), depending on temperature and other conditions, the male alligator raises his body, inhales deeply and exhales rapidly through both nostrils and mouth, the greater amount of air being emitted through the mouth. Simultaneously a loud guttural roar equalling in volume that of an enraged bull is emitted, and this is accompanied with body vibrations that foam the water and cause the surrounding land to tremble. A musky fluid is at the same time extruded from glands in the ventrolateral skin of the throat, and may be detected either by scent or taste by other alligators within a radius of several yards. If an interested female is within this range she moves alongside the male. There is no show of aggression on the part of either sex. If the male is thoroughly aroused he crawls toward her, climbs more or less gently onto her back and grasps her firmly around the neck with his front legs. The male's body (at the posterior end) is drooped over and to the side of the female's body, his vent pointed toward his mate's tail. The penis is large and curved and is placed along her tail and, with a few backward or forward movements, is inserted in the cloaca of the female. The pair may stay in this embrace for a few moments to several hours depending on

the condition of sexual excitment. When they separate the male seeks new partners and the female usually awaits the development of her eggs, although the same female has been observed united with a different male.

Under conditions of captivity the female alligator shows less parental care toward her eggs than does the female crocodile. Upon deposition of her eggs the female alligator often turns around and devours the eggs much more rapidly than she deposited them, and she sometimes neglects them completely. On the contrary, when the female American crocodile has finished egg-laying she shows a great ferocity toward either man or other nearby crocodiles. She tries to cover the eggs with her hind legs by digging frantically, even on concrete-bottomed enclosures. If any object is thrust near the eggs it is met by open jaws. After a time, if she discovers it is impossible to cover her eggs, she moves on, often returning to feast upon her own eggs.

Under natural conditions, soon after fertilization has taken place the gravid alligator selects a spot for a nesting site. She often wanders a considerable distance from the water level existing at the time, and seeks ground that has ample sunlight and humidity above the usual high water level. When the proper site is selected she gathers together a mound of usually fresh vegetation (mosses, ferns, sticks and leaves). This mound varies from two to four feet in width, from four to seven feet in length, and from one and one half to three feet in height. When construction of the nest is finished the female digs into the nest and deposits her eggs, numbering from five to seventy depending on the size of the particular female. Although the total number of eggs is often said to be much higher, it seldom exceeds forty-five. An extraordinarily large female might possibly lay as many as ninety eggs.

As the weeks pass the vegetation decays, giving off a considerable amount of heat. With the aid of the sunlight it holds a fairly high temperature both day and night. Under proper conditions the young hatch in from sixty to one hundred twenty days, temperature and precipitation playing a very important role in the speed of development.

It has been reported that the female alligator often revisits the nest and empties the contents of her urinary bladder upon the nest site to aid the incubation of her eggs. Actually, crocodilians do not possess a urinary bladder, although they do store quantities of fluid urine (not solid uric acid as in snakes and lizards) in the kidney ducts. Furthermore, it is my belief that alligators do not intentionally urinate on the nest to aid incubation. Alligators prefer to bask in an elevated area, and they also prefer (in captivity), a high, usually dry area for defecation and urination. Only as the nest conforms to these requirements is it favored as a site for urination.

Very seldom do alligators void wastes in their aquatic habitat, especially in captivity if kept in relatively clean enclosures. Captive specimens generally extrude waste in a dry portion of their quarters if available.

A great many writers seem to be convinced that the female alligator keeps a constant vigil over her young for often as long as three years. It is reported she excavates a small pool near the hatching site for her young to wallow in from one to three years after hatching. She supposedly keeps them herded here and protects them faithfully against all

intruders and predators. These suppositions are not borne out by my observations.

Upon emergence from their thin-shelled prison the young head directly toward the nearest water which is not a carefully planned "playground," but the shoreline of the pond, lake, or stream nearest their nest. They go immediately to the shallow waters bordering their possible future habitat. These shallows very seldom range over two feet in depth. They are usually small inlets cluttered with fallen branches and dense growths of cattails, ferns and grasses. This protective covering is also the habitat of water snakes, frogs, tadpoles and small fishes. These small vertebrates constitute the chief diet of the young alligator for the first four years of its life. At this time (eight to forty-eight inches in length) they are not of sufficient size to contend with larger prey. At this crucial age they have a great many predators to contend with—otters, turtles, snakes, skunks, raccoons, the larger wading birds and other alligators from six to fourteen feet in length. Although mentioned last, undoubtedly the alligator should rank relatively high in the list of the hatchlings' enemies.

When alligators reach their fifth year their feeding habits undergo a drastic change. They can no longer thrive on the small animal life that kept them in perfect health through early life. They then become true hunters and stalkers of prey. Any movement in the water is likely to be investigated. The size of prey becomes larger, consisting of aquatic birds, animals that take to or feed near the alligators' haunts, and larger fish. Young alligators are eaten as readily as other prey, regardless of possible relation. As the size of the alligator increases it becomes difficult for it to secure large food in any quantity. Accordingly the usual large alligator in the wild is not in the best of health.

If the young alligators are lucky and survive through this crucial stage of life they may reach sexual maturity in six or eight years, breeding at an age of perhaps ten to twelve years. The writer has not observed eggs being laid by younger specimens.

Several American crocodiles that were hatched at the Everglades Wonder Gardens laid their first clutch of eggs in their thirteenth year (1954), at a length of seven to nine feet. The same females have laid eggs for the last two consecutive years. It is unlikely that the alligator lays at an earlier age.

Many local residents within the range of the alligator claim that the eggs would not hatch unless they received the ardent care of the mother. This is entirely false, at least so far as postdepositional care is concerned. When the female has built her nest and laid the eggs she returns to her feeding area, her obligation to the survival of her species completed until the following year.

Many an observer has exclaimed, "I was taking a short cut to the fishin' hole and found a she 'gator tendin' her nest. She started at me and I git but fast." Several photographs of a female alligator "guarding" her nest have been published in many worth-while volumes. Was the animal truly guarding the nest?

Alligators, like many other reptiles, show a fondness for direct sunlight. In captivity they often congregate in large numbers, in the cool of the morning, in the sunlight. In the wild they have the tendency to

reach a high level for basking purposes. This high level could be rock, log or bank. Since the alligator's nest is built in close proximity to the water, in a position where it receives at least partial sunlight, it often provides an easily accessible basking site. If the nest is "protected" it is because of its role as a basking site, not as a nest.

Protection of the young is as much an illusion as protection of the eggs. Approach of any possible predator toward the young often provides an opportunity for a nearby adult alligator to obtain food. In other cases, when the adult is not hungry, the predator is driven away as a territorial defense. Rarely, in the case of large predators, is the enemy fought in direct self-defense.

Summary. During the height of the breeding season no violence is shown between the sexes. The female deposits her thirty or more eggs in a mound of vegetation and covers them with eight to twelve inches of the same material. She then returns to the water and takes up once more her every-day activities.

With proper conditions the young emerge from the eggs in approximately sixty days. They go directly to surrounding water and remain hidden until they are of sufficient size to cope with enemies and feeding problems. During this time they receive no deliberately protective attention from their mother. If the female should encounter her young and is hungry she will devour them. To her they are no more than small fish and an easily obtained meal.

Predators are driven away or killed by the adult alligator, not to protect the young, but to defend its territory, or for food, or for self-protection. The female alligator is not a protecting parent.

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AN UNUSUAL WATER SNAKE FROM MARYLAND.—Polychromic populations of *Natrix sipedon sipedon* (Linnaeus) occur naturally in various parts of Maryland (McCauley, 1945, The Reptiles of Maryland and the District of Columbia: 107-108). This note concerns another variant taken from an area occupied by a population other samples from which are typical of the species. The specimen in question (NHSM No. R510), a male, was taken in June, 1942, at Briarcliff-On-The-Severn, Anne Arundel County, Maryland, by Mr. J. Fulton Lewis.

The pattern of this *sipedon* is unique in three respects. First, the dark lateral extensions of the dorsal bands are not disconnected to form the quadrate blotches characteristic of the posterior region of *sipedon*. The bands are obscure on the rear third of the snake. Second, there is a dark mid-dorsal line, about two scale rows wide, extending from the head to the obscure posterior section (which is the same color as the line), uniting the bands on the dorsum. The bands are dark olive-brown, the ground color bronze or rusty. Third, the ventral surface is nearly completely devoid of pattern, save for small dark spots increasing in number towards the tail, which is rather heavily spotted. In this respect the specimen is similar to members of McCauley's Stump Neck population.—*John E. Cooper, Department of Herpetology, Natural History Society of Maryland, Baltimore.*

Sexual Dimorphism in the Hylid Frog *Agalychnis dacnicolor* Cope and the Status of *Agalychnis alcorni* Taylor

By WILLIAM E. DUELLMAN

As presently known the range of *Agalychnis dacnicolor* extends from southern Sonora southeastward along the Pacific slopes and lowlands to the Isthmus of Tehuantepec, Oaxaca. Throughout this area the species appears to be relatively uniform and shows no local differentiation.

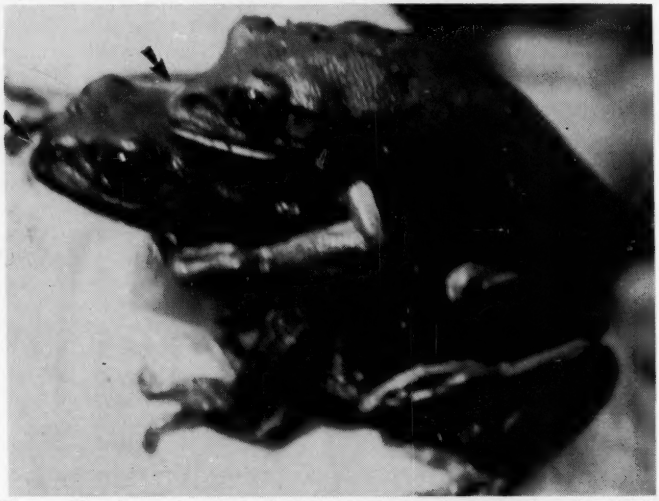
Taylor (Copeia, 1952, 1: 31-2) described *Agalychnis alcorni* on the basis of a specimen from the Río Tepalcatepec, 17 miles south of Apatzingán, Michoacán, and one from San Blas, Nayarit. Both of these localities are well within the range of *Agalychnis dacnicolor.* The type specimen of *alcorni,* a female, was diagnosed as differing ". . . from other Mexican species chiefly in having a short, high snout." The other characters listed in the diagnosis of *alcorni* apply equally well to *dacnicolor.*

In a series of 33 adults of *Agalychnis* collected near Coalcomán, Michoacán, in 1951, the sexes can be segregated on the basis of snout shape. In lateral view the snout of the male is relatively long and slopes gently upward to the eye with a slight hump above the nostril. The female, on the other hand, has a relatively short snout that is high and truncate (Fig. 1).

Fig. 1. Sexual dimorphism in the shape of the snout in *Agalychnis dacnicolor.*

During the course of field work in western México in 1955 and 1956, special efforts were made to determine the systematic status of *Agalychnis* in the area. Specimens collected in those years added to those already in the collections of the Museum of Zoology total 199, as follows: Colima (95), Guerrero (7), Jalisco (2), Michoacán (69) Morelos (3), Nayarit (9), and Sinaloa (14). Of these, eight are from the vicinity of Apatzingán, Michoacán, and may be considered topotypes of *alcorni;* 52 are from the vicinity of Colima, Colima, and may be considered to be topotypes of *dacnicolor.* Invariably, in these specimens the males have a long sloping snout, and the females have a short, high one. On July 1, 1955, *Agalychnis* was breeding near Coalcomán, Michoacán.

Several clasping pairs were found, and in each case the sexes were readily distinguishable by the shape of the snout (Pl. 1). Breeding choruses of *Agalychnis* were encountered in Colima, Michoacán, Morelos, Nayarit, and Sinaloa, but only one type of call was heard. Taylor mentioned that the type specimen of *alcorni* had in life a yellow venter. I have never seen specimens that were a true yellow; however, many are light creamish-yellow on the belly, whereas the throat is always white. On the basis of any known morphological characters, habits, or habitats, it is impossible to delimit two species of *Agalychnis* in western México.



Pl. 1. Clasping pair of *Agalychnis dacnicolor* from Coalcomán, Michoacán. The difference in the shape of the snout is apparent.

The name *Agalychnis alcorni* is based upon a female specimen of *Agalychnis dacnicolor,* and the species was diagnosed using the sexually dimorphic character of snout length and shape. Consequently, the name *Agalychnis alcorni* Taylor is a synonym of *Agalychnis dacnicolor* Cope.

Sexual dimorphism in the shape of the snout is not equally well developed in all members of the genus *Agalychnis*. There appears to be noticeable difference between the sexes in the shape of the snout in *Agalychnis callidryas* Cope, whereas in *Agalychnis moreleti* Duméril the males do have a more sloping snout than the females. However, the snout in the females of the latter species is not as short nor truncate as in females of *A. dacnicolor*.

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MUSEUM OF ZOOLOGY, UNIVERSITY OF MICHIGAN,
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The Snake *Farancia abacura*: An Attended Nest

By WILLIAM J. RIEMER

George P. Meade (1946) has summarized the information available on nesting and the brooding of eggs by *Farancia abacura* (Holbrook). A convincing number of instances is recorded in which a female, having laid a clutch of eggs, remained with them, often coiled about them (Meade, 1935, 1937, 1940, 1945; Goldstein, 1941; Reynolds and Solberg, 1942). In most instances the eggs were laid on the hard floor of a cage or pen and various circumstances eventually necessitated the removal of the eggs to an incubation container. The female always tended to remain with the eggs until they were removed from her care.

In one case (Meade, 1940) a natural nest was examined by a lumber worker soon after the attendant adult was killed. The eggs were just beginning to hatch, which suggests that the adult had been in attendance throughout the incubation period. Meade could not vouch for the accuracy of the report. However, it appears reasonable to expect that the female does remain with the eggs until hatching time.

The natural nest mentioned above was described (Meade, 1940) as being under a rotten log on a ditch bank well above water level. Another was said to be under a board. Goldstein (1941) describes in detail and illustrates a natural nest complete with partially developed eggs and an attendant adult. The nest was a shallow excavation in the side of a mound of soil. The opening was lateral. Eggs were embedded and also buried in the walls of the cavity. I know of no other descriptions of nests. Meade (1935) reports that a caged female, just prior to egg deposition, attempted unsuccessfully to dig in the soil of the cage floor. The laying of eggs in a nest in the soil is presumably the normal procedure.

Recently an additonal opportunity to observe a natural nest has come to hand. At dusk, 19 September 1956, J. C. Dickinson, Jr. removed a large adult female (169 cm. total length) from a natural nest-site in the damp sandy soil of a garden. The nest was located 1½ miles west, 2 miles south of Gainesville, Alachua County, Florida. It was situated about 150 feet from the shore of a small lake (Bivins Arm) and about 10 feet above ground water level.

The nest consisted of a flask-shaped chamber with a vertical neck 2 inches long and 2 inches in diameter, which communicated with a cavity 6 to 7 inches in diameter and about 4 inches in height. The chamber was apparently excavated by the occupant, who, because of her bulk, essentially filled the cavity. However, in the nest with the female and partially mixed with the surrounding soil were 13 hatchling *Farancia* and 36 collapsed shells. One of the young had died half emerged from the shell. No infertile eggs were present. Presumably the hatchlings unaccounted for had already forsaken the nest. The female and her young are now number 7632 in the University of Florida Collections.

The young snakes apparently hatched only a short time before discovery—a few days at most—since all except one showed the cloudy slate-blue color characteristic of this species just prior to ecdysis. This hue is assumed a few hours (Meade, 1937) to five days (Goldstein,

1941) after hatching. It is lost, along with the first skin, on the seventh or eighth day after emergence.

The number of eggs produced appears to vary considerably. Van Hyning (1931) reports a specimen killed on the highway as containing 104 white-shelled eggs. The measurements (21 x 30 mm.) indicate the eggs were of a size normal for laying. Clark (1949) reports one with 16 well-developed eggs. Other records of numbers laid (in captivity) or found in natural nests are 18, 22, 28, 29, 36, 40, 54. Dates of laying in captivity are 9, 14, 21, and 31 July; 10 August; and 5 September. Eggs artificially incubated for at least a part of their developmental period hatched on 8 and 20 September; 2, 6, 8, and 30 October. The naturally incubated clutch reported on here hatched about 16 September.

This report constitutes the second detailed description of a natural nest of *Farancia* and tends to confirm the previous suggestive evidence that normally the female excavates a soil chamber in which to deposit her eggs. It also confirms the presumption that normally the female remains at the nest with the eggs until hatching time, or probably even until the young have dispersed.

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Selected Comments on Amphibians and Reptiles From the Mexican State of Puebla

By Robert G. Webb and Charles M. Fugler

This report is based on a collection of amphibians and reptiles secured in the summer of 1955 under the auspices of the Museum of Natural History at the University of Kansas to which all catalog numbers cited in the text refer.

Of the 28 forms collected in Puebla, 14 have not previously been reported from the state. *Ninia diademata diademata* Baird and Girard (No. 39641, 10 mi. SW Villa Juárez) and *Trimorphodon latifascia* Peters (No. 39625, Km. 206 S Izúcar de Matamoros at Raboso) have previously been reported from Puebla only once. Ten of the 14 state records include *Bufo perplexus* Taylor, No. 39571, 6.5 mi. SW Izúcar de Matamoros; *Eleutherodactylus natator* Taylor, Nos. 39574-76, 10 mi. SW Villa Juárez; *Hyla smithi* Boulenger, No. 39595-39618, 6.5 mi. SW Loveridge, No. 39623, Atencingo, Ficimia publia Cope, No. 39646, 17 mi. N Tehuitzingo; *Cnemidophorus guttatus immutabilis* Cope, Nos. 39590-91, 17 mi. N Tehuitzingo; *Leptotyphlops maximus* Loveridge, No. 39623, Atencingo; *Ficimia publia* Cope, No. 39619, 22 km. W Izúcar de Matamoros; *Masticophis flagellum lineatus* (Bocourt), No. 39628, Izúcar de Matamoros, No. 39627, Atencingo, and No. 39640, 1.8 mi. N Acatlán; *Pseudoficimia pulcherrima* Taylor and Smith, No. 39624, Km. 192 on Mex. hwy. 190 N Izúcar de Matamoros at Galarza; and *Bothrops atrox asper* (Garman), No. 39652, approximately 20 mi. NE Villa Juárez. The variation exhibited by the species named above is encompassed by that given in existing accounts and the species otherwise require no further comment. The four remaining species, previously unknown from Puebla, are discussed below.

We are indebted to Mr. Dyfrig Forbes of Izúcar de Matamoros and members of a University of Kansas entomological field party for several of the specimens collected in 1955. We thank Dr. Edward H. Taylor for numerous courtesies during the preparation of the manuscript and Mr. Allen Medlin for the illustrations of *Geophis rostralis*.

Bufo cavifrons Firschein. Nos. 39586-89, Teziutlán. Two gravid females, 88 and 90 mm. in snout-vent length, and two juveniles 53 and 55 mm. in snout-vent length were taken in a light rain in a forest on moist leaf litter; juveniles were more abundant than adults.

Both adults agree in coloration and most particulars with the description of *Bufo cavifrons* (Firschein, 1950, Copeia, 2:81). Three characters, however, conform to the diagnosis of *Bufo cristatus*: 1) The tympanum has a slightly elevated border and is here considered small; it has a diameter of 4 mm. and is separated from the orbit by a distance of 5 mm. 2) The anterior edge of the parotoid gland extends beyond the posterior tympanic margin but does not reach the anterior tympanic margin; stated in another way, the tympanum is bordered superiorly by the parotoid. 3) the swollen and thickened parietal crests are more elevated than the other cranial crests and are here interpreted to merge laterally with the postorbital crests.

The two juveniles (Plate 1) differ from the adults in coloration in

that the former possess a uniform light tan dorsum and only a faint indication of a narrow light middorsal stripe, which is not bounded anteriorly by a black triangle. Also, the wide dark lateral bands are absent; there is, however, a narrow dark brown stripe extending posteriorly from the posterior rim of the orbit to the groin. An interparietal dark stripe is present; an interorbital dark stripe is absent. The venter, throat and undersurface of the limbs are mottled. The parietal crests are swollen and thickened, slightly higher than the other cranial crests and laterally merge with the postorbital crests; the lateral area of the postorbital region seems to be more flattened and gives the swollen parietal crests a more distinct and knoblike appearance than in the adults. The tympanum is small (diameter 2 mm.) and scarcely distinguishable.

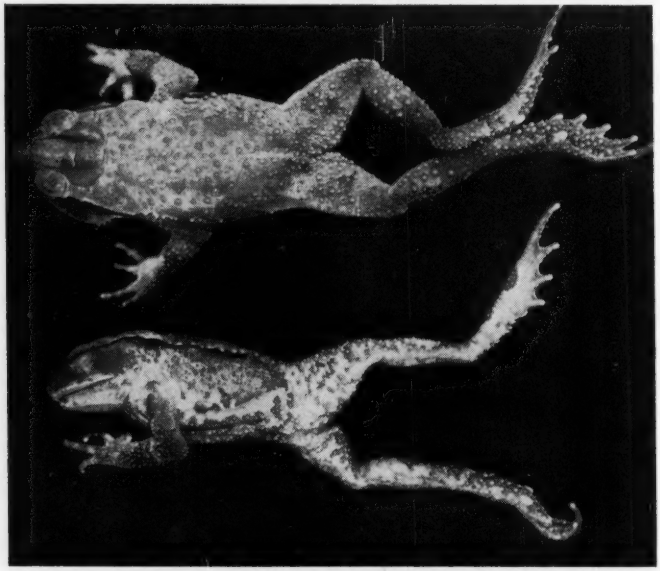

Plate 1. Juveniles of *Bufo cavifrons* Firschein, from Teziutlán, Puebla. Lateral view at left, 39589; dorsal view at right, 39587.

Except for the interparietal stripe and the absence of an interorbital stripe, the juveniles are referrable to *Bufo cristatus*. Although Firschein (*loc. cit.*: 84) reports that the lateral area of the body in *cristatus* is darker than the dorsum, no mention is made of the distinct, dorsolateral, dark brown stripe extending posteriorly from the orbit, which occurs in our specimens. The variation in coloration of adult female *cavifrons* is indicated by the report of Darling and Smith (1954, Trans. Kansas Acad. Sci., 57(2):185), who mention a large female *cavifrons* (snout-vent length, 91 mm.) that conforms to the coloration of *cristatus* in the same manner as our two juveniles do. The two juveniles are tentatively regarded as *Bufo cavifrons*.

Phyllodactylus magnus Taylor. Nos. 39620-22, Km. 206 S Izúcar de Matamoros at Raboso. A large individual has a snout-vent length of 67 mm. and lacks the tail. The smaller of two specimens, 47 and 50 mm. in snout-vent length, has the original tail, which is transversely banded, and shows no evidence of enlarged dorsal tubercles. The other small individual has only the basal portion of the tail; it is banded and has three annuli of slightly enlarged, unkeeled scales, separated by four rows of smaller scales. Collectively, the three specimens have 19-24 scales between the orbits, 12-14 longitudinal rows of enlarged dorsal and lateral tubercles, the ear opening not denticulate, and, in two specimens, the postmentals are in contact with two labials. The ground color above is a light tan with irregular, dark brown, rectangular spots; the head is spotted and reticulated. A dark stripe on either side of the head extends from the superior margin of the ear opening through the orbit to the narial opening; this stripe is less distinct in the largest specimen. In preservative, there is evidence of a yellow ventral coloration, most prominent ventrolaterally.

The three specimens are tentatively referred to this species. The low count of interorbital scales and the enlarged, but unkeeled, caudal scales in the small specimen, are at variance with the diagnosis given by Taylor (1942, Univ. Kansas Sci. Bull., 28(6):100).

Conophis vittatus vittatus Peters. No. 39626, male, Atencingo. The snout-vent length is approximately 520 mm. and the tail is 133 mm. An aberrant aspect of coloration is the pigmentation of the first dorsal scale rows. The temporal regions are anomalous; the parietal is incompletely divided anteriorly on the right side, and the temporals number 2-3, whereas on the left side the parietal is entire, the temporals number 2-3, but a small scale, bordered anteriorly by the postoculars, is inserted between the parietal and lower anterior temporal. In scutellation and other particulars of coloration, the specimen agrees with those described by Smith (1941, Jour. Wash. Acad. Sci., 31(3):119).

Geophis rostralis (Jan). No. 39642, female, 10 mi. SW Villa Juárez, found under a rock in an open grassy area near a small stream. Length of body, 157 mm.; tail, 29 mm.; 17 dorsal scale-rows without apical pits; 133 ventrals; 35 caudals; 5-6 supralabials; 6-6 infralabials; 1-1 loreals; 1-1 small postoculars; 1-1 temporals; anal plate entire; length of rostral from above about two-thirds its distance from the frontal; large internasals; anterior pair of chin shields in contact with mental; dorsal scales on tail and posterior part of body keeled; dorsal coloration dark brown; venter pale; caudals light brown.

There are few published accounts of *Geophis rostralis*, and to our knowledge, this is the first specimen with exact locality data from Mexico. Jan's (1865, Iconographie generale des ophidiens, livr. 12, pl. 2, fig. 2) illustration is the basis of the original description of *Elapoides rostralis*. Features shown in the drawing differ from those of our specimen in that the dorsal scales on the tail and posterior part of body seem not to be keeled and the internasals are much smaller, their posterior borders contacting the posterior end of the rostral; in our specimen the suture between the internasals is equal to two-thirds the length of the interprefrontal suture (Fig. 1A). Also the scales of the first dorsal row depicted by Jan are noted to be larger than those of the second row,

whereas the scales of the first and second dorsal rows are of the same size in our specimen. Boulenger (1894, Catalogue Snakes Brit. Mus., II:324) mentions carination of the scales on the posterior part of the body in a female, and that the internasals are fused with the prefrontals. Illustrations by Bocourt (1883, Mission scientifique au Mexique, pl. 31, fig. 10) show small internasals and carination of the scales on the posterior part of the body; the internasals seem to have the same configuration as those in the specimen figured by Jan.

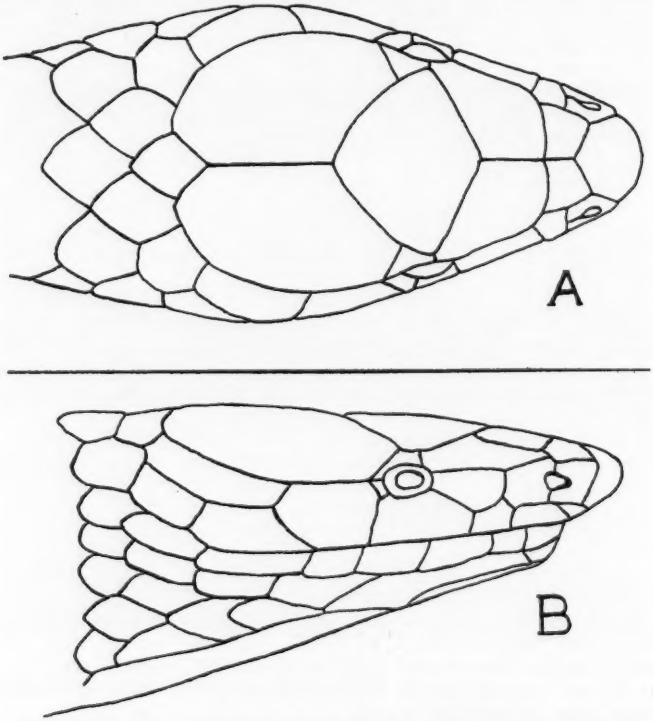

Fig. 1. Head scutellation of *Geophis rostralis* (Jan), 39642, from 10 mi. SW Villa Juárez, Puebla. A, dorsal view; B, lateral view.

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Description of a New Salamander of the Genus *Siren* From the Rio Grande

By COLEMAN J. GOIN

When I described *Siren intermedia nettingi* (Goin, 1942, Ann. Carnegie Mus., 29:211-217), I pointed out that certain specimens from southern Texas and northern Mexico differ from typical *nettingi* in several respects. The specimens available at that time, however, were both old and inadequate so a definite decision regarding their proper status was postponed. Several years later Brown (1950, Annotated Check List Rept. Amph. Texas: 36), in discussing specimens from the same area, pointed out that they differ from typical *nettingi,* referred to them tentatively as *S. lacertina* Linnaeus, and coined for them the appropriate common name "Rio Grande Siren."

In the past decade and a half the active group of herpetologists in Texas has collected enough fresh specimens of *Siren* from this region to permit reopening the question of their proper status. Knowing of my long interest in the group, they have kindly turned their material over to me for study.

Examination of this fresh material, along with re-examination of the specimens previously available, demonstrates that the population of Siren occurring in the Rio Grande Basin is, despite its high costal groove count, more closely related to *S. i. intermedia* Le Conte than to *lacertina,* and that it differs from its nearest relative, *S. i. nettingi,* in several respects. For it I propose the name

Siren intermedia texana, subsp. nov.
Rio Grande Siren

Type. TCWC[1] 10567, adult female, collected June 7, 1953, by W. P. Kerr.

Type locality. Texas, Cameron County, seven miles north of Brownsville.

Paratypes. Forty, as follows: TEXAS—TCWC 5038-40, 9002-3, Cameron Co., Brownsville; TCWC 10566, Cameron Co., 7 miles north of Brownsville; BCB 7572-77, Cameron Co., 3 miles south of Harlingen; TNHC 13987-88, Cameron Co., 3 miles southwest of Harlingen; TNHC 90, 6015-18, Cameron Co., 4 miles south of Harlingen; BCB 75-78, 349-51, Hidalgo Co., 10 miles west of Mission; TNHC 15287, Starr Co., 2½ miles southeast of Sullivan City; USNM 10853, 10855, 10857, 10861[2], Maverick Co., Upson. MEXICO—USNM 4048(a-g), 4075,

[1]BCB, collection of Bryce C. Brown; TCWC, Texas Cooperative Wildlife Collection, College Station, Texas; TNHC, Texas Natural History Collection, University of Texas; USNM, United States National Museum.

[2]This specimen has been sent on exchange to the Instituto Miguel Lillo, Tucuman, Argentina.

Tamaulipas, Matamoros; BCB 6197, Tamaulipas, 32 miles south of Matamoros.

Diagnosis. A Siren with 36-38 costal grooves (mode 37), a pointed tail and a pattern of tiny, discrete, black flecks on a dorsal ground color of grey or brownish grey. It differs from all living forms of *Siren* except *lacertina* in its high costal groove count. From *lacertina* it differs in having the dorsal dark spots minute, in having the underside of the limbs and the axillary region pale in color, in having, on the average, one less costal groove (av., 37.22 in *texana,* 38.45 in *lacertina*), and in having a pointed rather than a rounded tail.

From its nearest relative, *S. i. nettingi,* it differs in its greater maximum size, 624 mm. for *texana,* 428 for *nettingi,* and in having more costal grooves, mode 35, av. 34.97, in *nettingi* and mode 37, av. 37.22 in *texana.*

Description of type. Skin generally smooth in appearance, but head pocked with indistinct pits of variable size and body sprinkled with smaller pits visible under magnification; no large glands present; two parallel rows of small, indistinct, mucous pores on each side: a dorsolateral row extending from behind the gills along side of body and onto first few caudal somites and a lateral row, much less distinct, extending from behind the limb to nearly above vent; individual pores arranged in little hyphen-shaped groups, each group usually placed in center of a costal fold; a very faint, shallow mid-dorsal groove extending from between eyes to top of head.

Head somewhat elongate, widest just anterior to base of gills, thence tapering gradually to about level of eyes, then tapering more abruptly to a rounded snout; a slight swelling in each parietal region produced by jaw muscles; head bluntly pointed in outline as seen from side; mouth small, consisting of a crescentic, transverse portion anteriorly, followed by an inward curving arc on each side, ending on ventral surface on a line dropped from anterior border of eye; outline of upper jaw convex as seen from side due to pendulous upper lip; upper jaw projecting beyond lower; no canthus rostralis; loreal region slightly convex; nostril an elongate, longitudinal slit, its anterior corner on a line with anterior point of upper lip, nearly lateral in position but not quite visible from above; internarial distance taken ventrally, equal to interocular distance; eye small, not protuberant, without eyelids, but completely covered with a thin membrane; its diameter about 1/3 distance from posterior corner of nostril; inter-orbital distance about three times diameter of eye; head width 9.06 in snout-vent length; head length 7.40 in snout-vent length.

Body moderately robust, ovate in cross section, slightly deeper than wide; no middorsal groove evident, but a shallow midventral depression from region behind pectoral girdle to just anterior to vent. An injury, a hole through the back, apparently from a gig, present at about middle of body. Costal grooves 37, distinct, connecting across abdomen, extending well up on sides to above dorsolateral row of pores; vent small, ovate; internal lip heavily folded.

Tail 2.46 times in snout-vent length, ovoid in vertical cross section at base, becoming more and more compressed laterally to a flat tip; a low

dorsal keel beginning on posterior eighth of body and continuing as low dorsal fin on tail to its tip; posterior half of tail with a low ventral fin. Tip of tail broadly pointed.

Forelimbs present, small; fingers four, stout, 2-3-1-4 in order of decreasing length, not webbed; all fingers with brown, clawlike horny caps covering tips; no metacarpal tubercles present.

External gills three, upper longest, extending two and one half costal folds posterior to insertion of limb when adpressed along side. Branchial openings three, anterior smallest, middle largest, covered by bases of gills.

Tongue small, well back in mouth, its acutely pointed anterior third free; a dark horny sheath present at anterior end of lower jaw, in form of a transverse ridge curving backwards at its outer ends; a small, oval, horny patch at anterior edge of upper jaw; lower jaw with patches of recurved, sharply pointed, well separated teeth along inner margin of mandible anteriorly; tooth patches failing to meet at mandibular symphysis by about four millimeters; upper jaw toothless; a patch of palatine teeth on each side of roof of mouth, each patch made up of about eight rows of teeth, each row extending outward and backward; the two patches failing to meet anteriorly by about two millimeters and diverging strongly posteriorly; internal nares longitudinal slits just lateral to patches of palatine teeth, each naris bounded by a fold of tissue apparently functioning as a narial valve.

Measurements of type (in millimeters). Head length (tip of snout to base of foremost gill), 38; snout-vent, 281; tail, 114; forelimb, 22; total length, 395; head width (maximum), 31; body width (maximum), 36; body depth (maximum), 36.

Coloration of type (preserved). Dark grey above, lighter grey below. Region behind posterior corners of mouth, around vent, under gills, and under limbs practically devoid of pigment. Top of head and dorsum thickly sprinkled with tiny, discrete, rounded black spots.

Variation. In size the paratypes of *texana* range from 140 to 624 mm. in total length and 100 to 432 mm. in snout-vent length. It is thus the largest of the three races of *Siren intermedia.* The maximum snout-vent and total lengths I have seen for these three forms are: *intermedia* 240-381; *nettingi,* 307-428; *texana,* 432-624. In the ratio of tail length into total length there is also an average difference between these three forms. In the following figures the minimum and maximum are given first, followed by the average in parentheses. These averages are based on 43 adult *intermedia,* 100 adult *nettingi* and 29 adult *texana*: *intermedia* 2.39-4.22(3.03); *nettingi* 2.84-4.24(3.21); *texana* 2.98-4.27(3.38).

Table I below compares the number of costal grooves in the three subspecies of *intermedia.* The numbers across the top of the table refer to the number of costal grooves whereas the numbers under these refer to the number of specimens having that count:

Table I

	31	32	33	34	35	36	37	38	
intermedia	2	16	22	8					(av. 32.75)
nettingi			2	29	57	25	2		(av. 34.97)
texana						2	25	10	(av. 37.22)

In all of these specimens that have the normal complement, the fingers are 2-3-1-4 in order of decreasing length except one which has them 3-2-1-4. Four specimens out of the forty show some kind of digital anomaly; one specimen has no fingers on the left hand, one has 3 fingers on the left hand, one has 5 fingers on the left hand, and one has 5 fingers on the right hand.

Coloration and markings in the paratypes range from very dark grey with no discernible pattern to light grey with numerous scattered, small black spots.

The series of adults (B.C.B. 7572-77) from three miles south of Harlingen, Cameron County, Texas, was described as being bluish grey with a slight yellowish tinge in life. The series of young (B.C.B. 75-78, 349-51) was described as seal brown above and dull slate below in life. A single immature specimen (B.C.B. 6917) from 32 miles south of Matamoros was bluish grey in life with a light orange stripe on the side. This stripe is still apparent after ten years in preservative as are some light spots on the venter.

Geographic distribution. This new form seems to be essentially an occupant of the Rio Grande River Basin. All of the known specimens have come from the Basin within just a few miles of the river proper except B.C.B. 6197, which was taken 30 miles south of Matamoros, in northern Tamaulipas. *Siren i. nettingi* thus occurs in essentially all of Texas that is habitable to *Siren* except along the Rio Grande and in the southern tip of Texas where it meets, and intergrades, with *texana.* I have seen three specimens, TCWC 3222 from two miles south of Kingsville, Kleberg County, and TNHC 16750-51 from 2.3 miles southeast of Sandia, Jim Wells County, that I consider veritable intergrades. The former has 36 costal grooves, and latter two 37 each. Both of these localities are about 100 miles from the Rio Grande River. There are no known records of *Siren* from the intervening area. North and east of these counties typical *nettingi* occurs.

It is true that the evidence of intergradation, based only on three preserved specimens, is in need of confirmation and I hope that collectors in southern Texas will seize the opportunity to make detailed morphological and ecological studies of individuals from the region where the ranges of *nettingi* and *texana* meet.

Remarks. Since its high costal groove count and large size may lead this form to be confused with *lacertina,* a comparison is here given between the two,

Although approaching *lacertina* in size and in costal groove count, *texana* differs in several respects. In the preserved specimens in which the color pattern is discernible, the pattern is of tiny dark flecks rather than of larger round black dots as in *lacertina.* Also, *lacertina* adults differ in

the fact that the under surface of the arm and axillary region is pigmented whereas in *texana,* pigment is reduced in this area as well as behind the angles of the mouth. There is a definite difference in the shape of the tail, *lacertina* having the tail broadly rounded whereas in *texana* it tapers to a definite point. Furthermore, on a more subjective basis, *lacertina* seems to be a generally more heavy-set animal. In large, mature *lacertina,* the head seems small in comparison to the diameter of the body whereas in mature *texana* the head and body appear to be of nearly the same diameter. In short, *lacertina* gives the impression of being a fatter creature.

I suspect that *texana* may differ from *lacertina* also in feeding habits. Two of the larger specimens bear notes that they were taken on a fishing line that was baited with "minnow." In my experience in the southeast I have never heard of *lacertina* biting a line baited with "minnow" and I suspect that this seldom if ever occurs, even though fishing with minnows as bait is very popular in this region.

Key to the living Sirenidae

Since there have been three subspecies of *Pseudobranchus* and now a new race of *Siren intermedia* described since the last key to this family was published (Bishop, 1947, Handbook Salamanders), it may be appropriate to present a key to the living forms. If the salamanders of this family could be examined alive, very little difficulty would be had in identifying them. Unfortunately, however, this is seldom possible and we must depend to a large extent on costal groove count. In counting grooves in these salamanders, I have included all entire grooves from the one directly behind the limb to the one that enters the vent. In all except well preserved, fresh specimens the color pattern is of practically no value in identification. This is particularly true in the genus *Siren.* I believe, though, that the following key will work in most cases, and when the ranges are taken into consideration, should prove helpful in identifying the recent species and subspecies of this family of salamanders.

1	A single branchial opening on each side; three digits on each forelimb	*Pseudobranchus*—2
1′	Three branchial openings on each side; four digits on each forelimb	*Siren*—6
2(1)	Costal grooves 34 or more	3
2′	Costal grooves 33 or less. (Florida Peninsula south of Lake Okeechobee.)	*Pseudobranchus striatus belli*
3(2)	Lateral light stripe distinctly yellowish or tannish	4
3′	Lateral light stripe buff or greyish. (Peninsular Florida north of Okeechobee, except the Gulf Hammock Region.)	*P. s. axanthus*
4(3)	Snout pointed; no well defined light yellow middorsal stripe	5
4′	Snout truncate; dorsum with a definite median light stripe. (Gulf Coast of Florida from Citrus County north to Taylor County. This is the Gulf Hammock Region.)	*P. s. lustricolus*

5(4) Combined width of lateral stripes much less than width of dark area between them. (Southwestern Georgia and northern Florida west of Okefinokee Region to Gulf County.) ..... *P. s. spheniscus*

5′ Combined width of lateral stripes about equal to or exceeding width of dark area between them. (Atlantic Coastal Plain from Okefinokee Swamp, Georgia, northward to Charleston, Charleston County, South Carolina.) ..... *P. s. striatus*

6(1) Costal grooves generally 34 or more; pattern of dark spots or flecks on a light grey background 7

6′ Costal grooves 31-33, rarely 34; pattern generally uniform dark above. (Coastal Plain from South Carolina to Highlands County, Florida, and west to Florida Parishes of Louisiana ..... *Siren i. intermedia*

7(6) Costal grooves 37-39, rarely 36 8

7′ Costal grooves 34-36, rarely 33 or 37; light olive to grey above, black pigment restricted to very small dots. (Southern Louisiana northward to southern Illinois and Indiana, west and south to vicinity of Jim Wells County, Texas.) ..... *S. i. nettingi*

8(7) Olive to grey above, pattern of numerous, tiny, black, round flecks on top of head and dorsum, venter at times with light spots, particularly in young individuals; lower surface of limbs and axillary region pale; tip of tail pointed; generally 37-38 costal grooves. (Rio Grande Valley from Maverick County to coast and northern Tamaulipas just south of mouth of Rio Grande.) ..... *S. i. texana*

8′ Olive above with numerous circular black spots on top of head, dorsum, and sides; light markings on body, if present, restricted to lateral and ventrolateral rows of narrow, short white bars; lower surface of limbs and axillary region usually heavily pigmented; tip of tail rounded; generally 38-39 costal grooves. (Coastal Plain from District of Columbia, to southern Florida.) ..... *S. lacertina*

Acknowledgements. In addition to all of the people who have, in the past, made their collections of *Siren* available to me I particularly wish to thank at this time Dr. M. Graham Netting and Neil D. Richmond of the Carnegie Museum, Dr. Doris M. Cochran of the United States National Museum, Dr. Bryce C. Brown of Baylor University, Dr. W. B. Davis of Texas Agricultural and Mechanical College, and Dr. W. Frank Blair of the University of Texas, for making their respective collections of this new form, or comparative material, available to me.

DEPARTMENT OF BIOLOGY, UNIVERSITY OF FLORIDA, GAINESVILLE, and RESEARCH ASSOCIATE, CARNEGIE MUSEUM, PITTSBURGH.

Anesthesia in Turtles

By HAROLD M. KAPLAN and RICHARD TAYLOR

Anesthetics have been effectively used in reptiles (e.g. Karlstrom and Cook, Copeia 1955: 57-58), but systematized data for turtles seem to be deficient. The present study deals with the usage of ether, nembutal (sodium pentobarbital) and urethane in adult *Pseudemys spp.*

MATERIALS AND METHODS

Turtles before and during anesthesia were held at 20°C. with nembutal and urethane, and 23°C. with ether.

Administration of nembutal was (I.C.) intracardiac (cervical approach between neck and forelimb), (I.V.) intravenous (exposed ventral abdominal vein) or (I.P.) intraperitoneal (retrograde approach between tail and hind limb). Similar routes, plus oral intubation, were used for urethane. Nembutal was given as a 2 per cent solution. Urethane was occasionally used in 20 per cent but mostly in 40 to 50 per cent solutions.

Table 1

1. Effective dose, time to induce deep anesthesia, and duration of deep anesthesia in temperature-adapted turtles treated with nembutal, urethane, or ether.
2. Changes during anesthesia following effective doses by designated routes.

Tests	Nembutal			Urethane				Ether
Routes and numbers of animals.	I. P. (48)	I. V. (20)	I. C. (38)	Oral (35)	I. P. (41)	I. V. (32)	I. C. (27)	Inhalation (31)
Avg. effective dose and stand. dev. in mg./kg.	16.3±4.6	17.6±5.9	15.5±3.6	2,730 ± 415.0	2,780 ± 70.0	2,380 ± 415.0	1,720 ± 570.0	Large initial volume flow. Minimum air.
Avg. time and stand. dev. in minutes to induce deep anesthesia.	64.5±12.2	52.8±40.1	29.8±16.7	270.0 ± 216.0	144.0 ± 90.0	135.0 ± 61.2	126.0 ± 96.0	36.9 ± 17.0
Duration of deep anesthesia	Per cent of animals in deep anesthesia.							
A. At least 3 hrs.	100.0	80.0	55.2	100.0	100.0	100.0	100.0	100.0
B. At least 10 hrs.	0	0	0	85.7	90.2	87.5	51.8	38.7

	Approx. per cent of cases affected, in minutes following effective dose															
	30	60	30	60	30	60	120	300	120	300	120	300	120	300	45	360
Corneal reflex	100	100	100	100	100	100	100	80	83	51	100	97	89	67	100	100
Normal tone	23	0	35	0	0	0	3	0	2	5	0	0	0	4	0	0
Semirelaxed	62	32	40	45	29	5	54	24	42	7	16	13	15	44	6	23
Relaxed	15	68	25	55	71	95	43	76	56	88	84	87	85	52	94	77
Gross movements	79	58	75	55	76	34	82	46	44	15	78	44	59	33	10	16
Pupil uncharged	69	69	85	85	82	82	100	97	75	83	100	94	85	89	77	74
increased	23	23	15	15	16	16	0	3	20	12	0	3	15	11	19	7
decreased	8	8	0	0	2	2	0	0	5	5	0	3	0	0	4	19

Heart rate	Avg. heart rate in beats/min. and avg. rectal temp. in °C. External temp. for nembutal and urethane was 20°C; for ether 23°C.							
Unanesthetized	18.6±7.9	17.0±8.9	15.3±9.0	15.3±8.9	16.0±8.5	15.1±7.5	14.9±8.1	23.9±12.9
45 min. after dose	27.0±2.9	25.1±3.9	25.8±5.4	—	—	—	—	43.6±5.4
90 " " "	23.7±5.5	23.7±4.2	26.3±6.2	—	—	—	—	—
120 " " "	—	—	—	31.9±9.1	29.0±5.5	33.1±5.7	29.9±7.8	—
300 " " "	—	—	—	31.2±7.7	26.2±8.4	27.6±12.8	33.9±9.2	—
360 " " "	—	—	—	—	—	—	—	20.3±6.6
Rectal temp.								
Unanesthetized	19.8±0.2	19.3±2.4	19.8±1.7	20.1±5.2	19.6±1.2	21.5±0.1	21.4±1.3	23.0±1.7
45 min. after dose	19.2±0.03	18.7±1.1	19.2±1.5	—	—	—	—	23.4±1.6
90 " " "	18.4±0.9	18.4±0.2	19.1±1.5	—	—	—	—	—
120 " " "	—	—	—	19.9±4.7	19.2±0.3	20.9±1.4	20.0±4.6	—
300 " " "	—	—	—	19.6±4.9	18.9±0.1	19.7±1.2	20.0±1.3	—
360 " " "	—	—	—	—	—	—	—	22.4±0.3

Heart rates were obtained by surface electrocardiographic recording or by observation of the pericardium exposed by an electric drill press. Rectal temperatures in degrees centigrade were obtained with a deeply placed thermometer.

Other determinations included the time to achieve "deep" or "surgical" anesthesia, duration of deep anesthesia, muscle tone, movements, pupillary diameter, and the corneal reflex. Deep anesthesia is defined herein in terms of muscular relaxation, absence of response to pain stimuli, and loss of movement, and is not based upon anesthetic levels in the blood. All data are listed in Table 1.

Respiratory rate determinations were abandoned because of great variability in frequency and rhythm (Pope, 1955, The Reptile World).

EXPERIMENTAL DATA

I. *Nembutal.* The average effective dosage was essentially the same by any route. Deep anesthesia was achieved earliest (one-half hour) by the I.C. route, but it persisted longest after I.P. injection.

The average heart rate always increased up to 45 minutes after injection. After 90 minutes it increased at a lesser rate with I.C. injections but otherwise decreased slightly. In several individuals the rate fell throughout, or else rose and then fell. Recomputed as an average percentage change with time (*i.e.* the average of the deviations of each animal from its own normal heart rate), the greatest per cent of increase at any time occurred with I.C. injections.

The average rectal temperature in all routes only slightly fell up to 90 minutes after injection. In several individuals the temperature rose or did not change.

The corneal reflex was always present, except during overanesthesia. Muscle relaxation was accomplished most frequently by I.C. injection. Gross movements tended to lessen or disappear in all routes. As a rule, pupillary diameter remained unchanged.

II. *Urethane.* The average effective dosage was much higher than that for nembutal. It was about equally high for oral and I.P. routes, less for I.V. and least for I.C. injections.

The time to produce deep anesthesia decreased through oral, I.P., I.V. and I.C. routes.

The anesthetic effect was most persistent with urethane. The per cent of animals in deep anesthesia at 10 hours decreased slightly through I.P., I.V., oral and I.C. routes. The lesser duration with oral use did not appear to result from incomplete absorption since the effective oral dosage was not disproportionately high.

The average heart rate in all routes increased for 2 or more hours after giving urethane. At 5 hours it still increased in the I.C. route, but it tended to decrease in the other routes.

The average rectal temperature in all routes only slightly tended to fall throughout 5 hours. The average per cent decrease was initially greatest in the I.C. route.

The corneal reflex varied through difficulty in controlling the depth of anesthesia. It tended to disappear in all routes (except I.V.) throughout 5 hours. Muscle tone variably decreased. Tone decreased earliest after I.C. injection, but the animals did not remain relaxed as long. Gross movements lessened or disappeared throughout 5 hours. In most cases pupillary diameter remained unchanged.

III. *Ether.* The average time to induce deep anesthesia was considerably less than that for urethane, and it almost equalled the quickest (I.C.) nembutal effect. Deep anesthesia persisted much longer than after nembutal, but less than after urethane. At 6 hours anesthesia had lessened in several animals, although at 10 hours 7 of 31 animals were still in deep anesthesia.

The average heart rate increased up to 45 minutes after etherization, and then fell sharply, becoming subnormal at about 5 hours.

The average rectal temperature rose slightly for 45 minutes, after which it fell slightly through the next 5 hours.

The corneal reflex, as in anesthesia with nembutal but unlike that with urethane, never disappeared. Muscle tone gradually decreased, the maximum relaxation occurring during the first few hours. Gross movements were generally absent throughout 5 hours of observation, slowly reappearing thereafter. In most cases pupillary diameter remained unchanged.

DISCUSSION

Ether is an excellent anesthetic for turtles, although because of low metabolism and respiration the drug is not easily eliminated, and the animals do not awake for many hours. Ether should be administered with a fairly snug-fitting nasal cone with provision for air intake. A high initial concentration of ether vapor with minimal air is suggested. No quantitative data about the inspired air and its rate of inflow were taken.

Nembutal is very satisfactory. It is effective in small controllable dosages, and administered by readily available routes. Like ether, it induces deep anesthesia in approximately ½ to 1 hour. The animals are unconscious for several hours (variable with the route) and they recover fully. On the average, animals are effectively relaxed in 1 hour, although ether promotes muscle relaxation earlier and in a greater percentage of cases.

Urethane is not recommended for routine use. The effective doses are too high, it takes too long to induce surgical anesthesia, and the animals do not readily regain consciousness. The drug is effective, however, in all routes examined. It maintains good muscle relaxation for several hours.

A considerable variability of response may be expected with all the drugs.

SUMMARY

Ether, nembutal and urethane can all produce "surgical" anesthesia in turtles. Urethane is the least satisfactory. The effective dosages, time to achieve anesthesia, duration of anesthesia, and other pertinent data, are reported for the three anesthetic agents.

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FURTHER NOTES CONCERNING ALGAL GROWTH ON THE PAINTED TURTLE.—The following observations are corroborative with respect to a previous note concerning algal growth on the eastern painted turtle, *Chrysemys picta picta* (Schneider), in Connecticut (Moski, Copeia, 1955: 61). More extensive observations and collecting during the summer of 1954 and the spring of 1955 have brought to light further information regarding this symbiotic interrelationship.

Careful observations of the *Chrysemys* population, by the use of a 40X telescope as the turtles basked, at the pond in Hamden, Connecticut, from which the writer had previously collected two epizoized females, revealed many adults with algal growth on their shells. Two females, collected on July 18, 1954, to confirm this visual evidence, had a spotty colonization of *Basicladia crassa* Hoffm. and Tild., embracing all the marginals and laterals 3 and 4 to central 5.

On August 1, 1954, May 22 and May 26, 1955, 7 female *Chrysemys p. picta,* varying in length of carapace from 43 to 146 mm., were taken at Lake Whitney, a reservoir in Hamden. All possessed a growth on the shell of *Basicladia chelonum* (Collins) Hoffm. and Tild. The colonization varied from sparse to dense, and from a limitation to posterior shell regions to a random distribution over the entire carapace.

An immature female (carapace 65mm.) captured on May 25, 1955, in a pond in North Haven, Connecticut, inhabited primarily by the spotted turtle, *Clemmys guttata* (Schneider), showed a sparse growth of *Cladophora Kuetzingiana* Grunow, involving laterals 3 and 4, central 5, and marginals 7 through 11, with a minute amount on the precentral.

Out of 47 epizoized *Chrysemys,* Edgren, Edgren, and Tiffany (1953, Ecology, 34: 733) found only 4 subadult or immature individuals, each several times hatchling size. They observed that juvenile turtles do not seem to be affected. On the contrary, in the writer's collection the ratio of young with algae to sexually mature turtles is much greater (5 subadults out of 11 specimens), and specimens having a carapace as short as 43 mm. are included in the collection. Four of these are from the Lake Whitney location, and if indicative of the entire population, show a tendency to algal infestation in subadults. It can also be noted that all of the *Chrysemys* specimens from Lake Whitney were colonized by *Basicladia chelonum.* A tentative explanation for this is spore distribution by the alga from the numerous *Sternotherus odoratus,* which also exhibit *B. chelonum,* present in the immediate area.

The writer wishes to acknowledge his appreciation for the courtesy of both Prof. William Randolph Taylor, University of Michigan, and Prof. G. W. Prescott, Michigan State University, in determining the algal identifications.—*Henry C. Moski, Peabody Museum of Natural History, Yale University, New Haven, Connecticut.*

The Status of *Rana capito stertens* Schwartz and Harrison

By Wilfred T. Neill

On October 7, 1955, at the Fifth Annual Meeting of the American Society of Ichthyologists and Herpetologists, Southeastern Division, a paper entitled "Frogs of the *Rana areolata* Group in the Southeastern States," by William E. Brode and myself, was presented (see Copeia 1, 1956: 72). In this paper we pointed out that a subspecies of gopher frog, distinct from the Florida one and from *R. sevosa* Goin and Netting, inhabited the Atlantic Coastal Plain of southeast Georgia and adjacent portions of South Carolina. We also exhibited a typical example of this distinctive population, along with other material from Florida and Mississippi. Schwartz and Harrison (1956, Proc. Biol. Soc. Wash., 69: 135) have recently described the aforesaid population as a new subspecies, *R. capito stertens*. Certain of my notes on this frog still appear to be worthy of publication.

Goin and Netting (1940, Annals Carnegie Mus., 28: 137-169) reviewed the frogs of the *Rana aerolata* group. At that time it seemed that the northern crayfish frog, *R. a. circulosa* Rice and Davis, ranged southward into northern Mississippi; a supposedly distinct species, the Florida gopher frog, *R. capito* Le Conte, occupied a relatively restricted range in the Coastal Plain from North Carolina through most of the Florida peninsula; and another supposedly distinct species, the dusky gopher frog, *R. sevosa*, occurred west of Mobile Bay from southern Alabama to southeastern Louisiana.

Several people have been disinclined to recognize *Rana sevosa* as a distinct species. In Schmidt's 1953 Checklist, for example, one finds *"Rana capito capito"* and *"Rana capito sevosa"* listed, each as a "new combination." Actually they were not new combinations, for Wright and Wright had so listed them in the second (1942) edition of their "Handbook of Frogs and Toads" but not in the third (1949). Specimens of *R. sevosa* had been collected years before by Morrow Allen, H. P. Loding, Julius Hurter, John K. Strecker and Percy Viosca, and had been classified either as *R. areolata* or as *R. "aesopus."* (Until 1935 the latter name had generally been used for the Florida gopher frog.)

At the time of Goin and Netting's study, the greatest hiatus anywhere within the range of the *Rana areolata* group was to be found in the Carolinas. No significance was attached to this gap, which apparently was attributed to lack of collecting. Nevertheless, a smaller gap between *R. a. circulosa* and *R. sevosa* in Mississippi, and another between *R. sevosa* and *R. capito* in the area from Mobile Bay to the Apalachicola River, were considered significant, real, and evidence that the three forms should be listed as distinct species. Goin and Netting (*op. cit.*: 162) suggested that many organisms, assumed to range from Florida to New Orleans, actually were lacking between the Apalachicola River and Mobile Bay. They further suggested that the gopher tortoise, *Gopherus polyphemus*, was one of these. This would be significant, if true, since both *R. capito* and *R. sevosa* inhabit tortoise burrows frequently (but not exclusively). However, two summers of extensive collecting in the Cen-

tral Gulf Coast region, plus examination of the material accumulated by Dr. Ralph Chermock at the University of Alabama, led me to conclude that in most cases the supposed hiatus resulted only from incomplete collecting. Certainly this is true of the gopher tortoise, which occurs at numerous localities between Mobile Bay and the Apalachicola drainage (Harper, 1943, Geol. Surv. Alabama, Monograph 10: 158; Neill, 1954, Pubs. Research Div., Ross Allen's Reptile Inst., 1 (7): 84).

Shortly after *Rana sevosa* was described, it became evident that gopher frogs were more widespread in Alabama than had been realized; Loding had taken them in Mobile County, Viosca had heard the call of *"aesopus"* in the same area, and a preserved example from Baldwin County was examined (Netting and Goin, 1942, Copeia 4: 259). This last locality is east of Mobile Bay; and the frog therefrom, while assigned to *R. sevosa,* showed an approach to *R. capito.* Netting and Goin (*idem*) were thus led to suggest that these two forms might be found to intergrade. In 1954 I collected a gopher frog (No. 16449 in the collection of E. Ross Allen and the author) near Ebro, Washington County, Florida, about 80 miles east of the nearest *sevosa* record. It measures 68 mm. in snout-vent length, about the size of most breeding male *sevosa* but a little smaller than the average *capito.* Of course it may not be fully grown. As in *capito,* the body tapers from a broad head to a narrow waist. The dorsolateral glandular folds are broad as in *capito,* but resemble those of *sevosa* in being colored like the dorsum. In life the ground color of the dorsum was very light gray, and thus more characteristic of *capito.* The venter and concealed surfaces of the hind limbs are spotted as in *sevosa.* The dark bars of the hind limbs are broader than the interspaces separating them, again as in *sevosa.* The spots of the dorsum are fairly distinct, being somewhat intermediate between *sevosa* and *capito* in this regard; they appear to be more numerous than is usual in *capito,* approaching the *sevosa* condition. The dorsum is relatively smooth, not warty, agreeing better with *capito* in this respect. Near Wewahitchka, Gulf County, Florida, just west of the Apalachicola drainage, I collected a gopher frog (ERA-WTN No. 16450) which, although clearly referable to *capito,* suggested *sevosa* in its relatively dark ground color and indistinct dorsal spotting. (It may be mentioned in passing that the species is not rare west of the Apalachicola drainage in Gulf and Calhoun counties, Florida; I have often heard choruses in this area.) The hiatus, both geographic and zoölogical, between *capito* and *sevosa* has largely been bridged, and the two appear to be conspecific. The relationship of *sevosa* with *R. areolata circulosa* now merits consideration.

At the time of Goin and Netting's review, *Rana areolata circulosa* had been collected as far south as Pontotoc County, Mississippi, and *R. sevosa* as far north as the northern border of Jackson County, Mississippi. Thus a gap of more than 200 miles apparently separated the two forms. However, at the 1954 meeting of the ASIH I was shown a living frog said to have been from Terry, Hinds County, Mississippi, a locality approximately in the middle of the supposed hiatus. It somewhat resembled a gopher frog but also resembled a crayfish frog, thus awakening the suspicion that *sevosa* and *circulosa* might intergrade.

Mr. Brode has taken several hundred frogs of the *Rana areolata* group in Mississippi, the majority of them from the coastal counties but some from as far north as Beaumont, Perry County. Through Mr. Brode's courtesy I examined 70-odd living gopher frogs from four miles west of Lyman, Harrison County. The locality should be within the range of *R. sevosa,* but the approach to *R. a. circulosa* was quite evident in these specimens. *R. sevosa* is said to be dark, frequently so dark that dorsal spots cannot be detected, but this series varied individually from light to dark, and most of the frogs were light enough to be plainly spotted. The venter was flecked or spotted, as is characteristic of *sevosa.* This form is said to have a very warty dorsum and broad dorsolateral folds as compared with *circulosa;* the frogs of the present series were variable in this regard, but most of them were scarcely wartier than the usual *circulosa.* None approached the wartiness of the specimen used by Goin and Netting to illustrate *sevosa.* These authors stated that *circulosa,* in contrast with *sevosa,* in life displayed a yellow suffusion in the groin and on the concealed surfaces of the hind limbs. All the frogs of the Lyman series displayed a yellow or orange suffusion, when alive or freshly preserved. *R. sevosa* is said to have a proportionately wide head and narrow waist as compared with *circulosa.* A few of the present series, kept alive in dry surroundings, soon came to show the cuneate build, but freshly caught specimens, well fed and not dessicated, did not differ from *circulosa* in this regard. *R. sevosa* seems to be a population of *R. areolata* distinguished mostly by the presence of more melanin, which results in a darker dorsum and a more heavily marked venter. Other differences from *R. a. circulosa* are average ones and not very impressive in living material. Terry and Beaumont specimens show an even closer approach to *circulosa* than do the Lyman ones. Accordingly, I feel that *sevosa,* and therefore *capito* as well, should be listed as subspecies of *R. areolata.*

In 1947 I collected a gopher frog at Bascom, Screven County, Georgia. The locality constituted a range extension northward in the state, but the specimen was newly transformed and differences from the Florida gopher frog were not evident. In 1953 Mr. Francis L. Rose collected an adult gopher frog (ERA-WTN No. 16457) near Green's Cut, Burke County, Georgia. It was very different from the gopher frog of Florida. Further search revealed a distinctive population ranging at least from southern Richmond to central Screven County, Georgia, in the Upper Coastal Plain. Calls of the species were also heard in nearby Allendale and Barnwell counties, South Carolina. The Georgia examples obviously constituted a subspecies distinct from the Florida one and also from *sevosa.* They were very dark or slaty above, so that dorsal spots could scarcely be made out, and the venter was heavily marked with minute dark flecks aggregated to form a clouded or marbled pattern. (Dr. Coleman J. Goin, who examined one of the Georgia specimens, stated that he had never before encountered such a ventral pattern in any member of the *Rana areolata* group.) The dorsolateral glandular fold was colored like the body, not bright yellow or orange as in Florida examples. The warts of the back were large, numerous and closely approximated, almost pavement-like. These were the characteristics used by Schwartz and Harrison (*op. cit.*) to diagnose their "*Rana capito stertens.*" The Georgia specimens display

two other noteworthy features: the lateral vocal sacs of the breeding male are large and deep black in color, and the size of the breeding male is large, about 90 to 100 mm. in snout-vent length. (I have not seen a female of this population.)

Evidently, the form described as new by Schwartz and Harrison is not confined to the Carolinas but occurs also in southeast Georgia. In my opinion a new name was not needed for it. In Schmidt's 1953 Checklist (p. 78), the type locality of Le Conte's *Rana capito* was given without comment as Riceborough, Liberty County, Georgia. (The accepted spelling is "Riceboro." However, Le Conte's type locality was no more explicit than "Georgia" (1855, Proc. Acad. Nat. Sci. Phila., 7: 425). It is true that one of the Le Conte plantations was at Riceboro. However, the Le Contes played host to many visiting scientists and collectors, such as Dr. W. L. Jones and C. C. Jones; and much material, sent to the U. S. National Museum from Riceboro, obviously was not collected there. (Examples are *Cryptobranchus, Gyrinophilus,* and *Desmognathus f. fuscus.*) Le Conte supplied a habitat note, to the effect that his frog inhabited rice-field ditches; but this comment is not especially helpful since at that time rice was widely grown in the Georgia Coastal Plain. In 1954, through the courtesy of Dr. Doris Cochran, I examined the supposed holotype of *Rana capito* in the U.S. National Museum collection. This specimen (USNM No. 5903) is a full inch shorter in snout-vent length than Le Conte's measurement would indicate, and so may not be the actual example Le Conte had before him. In any event, it is so soft and bleached that subspecific determination is not possible now. Le Conte's description is perfectly clear, however, and was also accompanied by a well-done plate. Le Conte's single specimen, upon which he based the name *Rana capito,* was indicated to be a male of very large size, dark gray or slate in color above, heavily speckled and mottled with dark below, with dorsolateral glandular ridges not yellow but colored like the body, and very warty. This description unequivocally refers to the frog which Schwartz and Harrison later called *"stertens."* These authors apparently were aware that the holotype of *capito* was not necessarily from Riceboro ("presumably" from Riceboro, they stated); that the supposed holotype, USNM No. 5903, is "26.7 mm. smaller" than Le Conte's measurement; that it is now unidentifiable subspecifically; that the dorsolateral glandular folds of Le Conte's specimen were not yellow but colored like the dorsum; and that these folds are yellow in the Florida gopher frog but colored like the dorsum in *"stertens."* Schwartz and Harrison advanced only one reason for coining a new name: "We have seen no material from Georgia . . . which agrees with our concept of *R. c. stertens* as here defined." Unfortunately, Schwartz and Harrison's paper came as a surprise to those who had a prior interest in the problem; otherwise, it might have been possible to point out the occurrence of *"stertens*-like" frogs in southeast Georgia, and so to avoid multiplication of names.

It may be noted in passing that two herpetologists were able to compare the holotype of Le Conte's *Rana capito* with that of Cope's *R. areolata aesopus* (definitely a Florida gopher frog), at a time when both specimens were relatively fresh. Dickerson (1906, The Frog Book: 192, footnote 2) and Stejneger (*in* Boulenger, 1920, Proc. Amer. Acad. Arts

Sci., 55 (9): 467) both concluded that the holotype of *R. capito* was not identical with the Florida gopher frog, but was *R. areolata.* Of course, these early identifications cannot be taken too seriously. However, Dickerson was familiar with the Florida gopher frog, of which she provided a description and several excellent photographs in her handbook. It thus seems likely that the holotype of *R. capito* did not especially resemble the Florida subspecies. It is not surprising that the holotype was confused with *R. areolata,* for the large, dark gopher frog of Georgia and the Carolinas superficially resembles many examples of the Texas subspecies.

The gopher frog ranging from North Carolina into southeast Georgia is therefore to be known as *Rana areolata capito* Le Conte, of which *Rana capito stertens* Schwartz and Harrison is a synonym. As a common name I suggest "Georgia gopher frog," for the type locality is in Georgia and the frog sometimes inhabits gopher tortoise burrows in this state. (The tortoise is absent from North Carolina and nearly all of South Carolina.) The known range of the Georgia gopher frog extends at least from the Lower Coastal Plain of North Carolina (Beaufort County) to southeast Georgia (Screven County). Probably it ranges much farther westward in Georgia. From both a geographic and an ecological standpoint, the population in Bleckley County, Georgia, reported by Brandt (1953, Herpetologica 9 (3): 141-145), should be referable to *R. a. capito.*

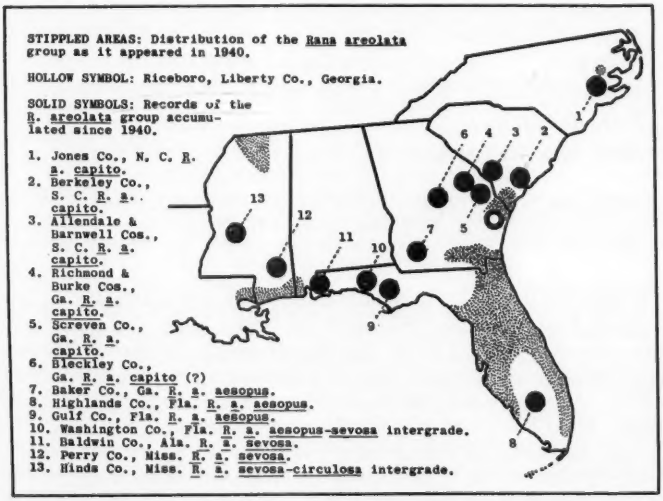
STIPPLED AREAS: Distribution of the Rana areolata group as it appeared in 1940.
HOLLOW SYMBOL: Riceboro, Liberty Co., Georgia.
SOLID SYMBOLS: Records of the R. areolata group accumulated since 1940.
1. Jones Co., N. C. R. a. capito.
2. Berkeley Co., S. C. R. a. capito.
3. Allendale & Barnwell Cos., S. C. R. a. capito.
4. Richmond & Burke Cos., Ga. R. a. capito.
5. Screven Co., Ga. R. a. capito.
6. Bleckley Co., Ga. R. a. capito (?)
7. Baker Co., Ga. R. a. aesopus.
8. Highlands Co., Fla. R. a. aesopus.
9. Gulf Co., Fla. R. a. aesopus.
10. Washington Co., Fla. R. a. aesopus-sevosa intergrade.
11. Baldwin Co., Ala. R. a. sevosa.
12. Perry Co., Miss. R. a. sevosa.
13. Hinds Co., Miss. R. a. sevosa-circulosa intergrade.

Fig. 1. Distribution of *Rana areolata* in the southeastern states.

The southernmost known Georgia locality for *Rana areolata capito* (Bascom, Screven County) is about 80 miles N-NW of Riceboro; and the southernmost South Carolina locality (Pinelands, Jasper County) is only 65 miles N-NE of Riceboro. The Florida gopher frog ranges into extreme southern Georgia, at least as far north as Waycross, Ware County, about 70 miles SW of Riceboro. At present it is uncertain as to which

subspecies occupies the intervening area. In other words, Riceboro lies in the middle of this *terra incognita;* it would be premature to insist upon a Riceboro type locality for Le Conte's *capito* although it may be possible some day to do so, when more is known of gopher frog distribution in south Georgia.

With the name *capito* restricted to the Georgia-Carolina population, the name *Rana areolata aesopus* Cope (1886, Proc. Amer. Phil. Soc., 23: 517) becomes applicable to the Florida one. This usage is, of course, familiar; the Florida gopher frog was generally called *aesopus* until 1935. The type locality of *aesopus* is Micanopy, Alachua County, Florida; and the holotype, USNM No. 4743, is clearly representative of the Floridian population.

With evidence of intergradation between the northern crayfish frog, *Rana areolata circulosa,* and the dusky gopher frog, the latter becomes *R. areolata sevosa.* This is not a new combination, having been used by Viosca (1949, La. Acad. Sci., Pop. Sci. Bull. 1: 10).

The frogs of the *Rana areolata* group should therefore stand as:

RANA AREOLATA AREOLATA Baird and Girard. Southern crayfish frog.

RANA AREOLATA CIRCULOSA Rice and Davis. Northern crayfish frog.

RANA AREOLATA SEVOSA Goin and Netting. Dusky gopher frog.

RANA AREOLATA CAPITO Le Conte. Georgia gopher frog.

RANA AREOLATA AESOPUS Cope. Florida gopher frog.

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ADDITION TO THE HERPETOFAUNA OF KOREA.—In a recently published article, "The reptiles and amphibians of Korea" (Shannon, Herpetol., 1956, 12 (1): 22-49) reference to Dr. Karl P. Schmidt's *Bufo stejnegeri* (Copeia, 1931, 3: 93-94) was inadvertently omitted. This is particularly unfortunate, as there is no doubt that the species is valid. Described from Songdo (Kaesong, Kyonggi Do), Korea, the species may be differentiated from *Bufo bufo gargarizans* by conspicuously smaller paratoids, long slender limbs, and complete concealment of the tympanum.

Dr. Schmidt (*fide* correspondence) expressed regret that no individuals have been reported since the description of the holotype. He feels, and I concur, that the animal is probably found in the extension of the Manchurian mountain range into northern Korea. This, of course, could explain why none has been collected by herpetologists attached to the United Nations armed forces stationed in Korea. — *Frederick A. Shannon, Wickenburg, Arizona.*

Notes on a Collection of Reptiles and Amphibians From Antigua, B.W.I.

By W. GARDNER LYNN

A four-day stay in Antigua, 10-14 August, 1953, provided the author an opportunity to collect at a number of localities in that island. Two species of amphibians and five species of reptiles were obtained. One of these, *Bufo marinus*, does not seem to have been recorded from Antigua previously but it is a favorite species for introduction all over the West Indies and its presence in this island is certainly not surprising. Four species which have been listed from Antigua in the literature are not represented in this collection. One of these, however, is almost certainly extinct and another is based on a rather doubtful early record. *Alsophis leucomelas antiguae* Parker was described on the basis of two juvenile specimens in the British Museum and was considered at that time (Parker 1933, 1936) as an extinct form. *Leptodactylus fallax* Muller is listed for Antigua by Dunn (1934) on the authority of Günther's record (Cat. Batr. Sal. Brit. Mus., 1858: 28) of a specimen given as *Cystignathus fuscus* "Adult: stuffed); no collector named." Dunn notes that the specimen is apparently no longer extant. *Leptotyphlops albifrons* (Wagler) is, according to Dunn (1934), represented by specimens from Antigua in the British Museum. *Hemidactylus mabouia* (Moreau de Jonnés), the widely introduced African lizard, is recorded from Antigua by both Parker (1933) and Dunn (1934).

Antigua is one of the small limestone islands of the Lesser Antillean chain which is believed to have appeared during the Upper Miocene emergence. It is about 16 miles long by 13 miles wide and has an area of 108 square miles. Its highest point, Boggy Peak, has an elevation of 1330 feet. Although much of the land has been planted to sugar cane for several hundred years there are some fairly extensive uncultivated areas covered with a rather low bush. Unfortunately the mongoose is present in Antigua and the reptile population has undoubtedly suffered in consequence.

My trip to Antigua was made possible during my tenure as a Fulbright Scholar at the University College of the West Indies. I am indebted to Dr. Doris M. Cochran for permission to examine Antiguan and other West Indian material in the United States National Museum and to Mr. Ernest Williams for information concerning some of the material in the Museum of Comparative Zoology, Harvard University.

Bufo marinus (Linnaeus)

One adult, 84.0 mm. long, was taken on Boggy Peak and several newly transformed young were found at the edge of a small stream near Bishop's Town. It would appear that this toad is not now uncommon in Antigua. It may be a relatively recent arrival for Dunn (1934) specifically remarks upon its absence from this island.

Eleutherodactylus martinicensis (Tschudi)

A total of 32 specimens, ranging in length from 16.5 to 30.0 mm., was collected. Some of these were taken at night on bushes in the garden of the Kensington House Hotel in St. John's and in a cane field by the roadside near All Saints. The others were collected during the day beneath cocoanut trash and stones at the following localities: cocoanut

grove on beach, one-half mile west of Crab Hill Village; by stream near Bishop's Town; near Old Road Town. It is perhaps noteworthy that the population of *E. martinicensis* on Antigua seems to show a rather high percentage of individuals with broad light stripes on the sides. Eleven of the 32 specimens collected have this color pattern, a much higher proportion than is found in Jamaica. Five of these 11 also have thin middorsal light stripes. In addition there are 8 specimens with thin middorsal stripes and no lateral stripes. Three specimens are females with large ovarian eggs showing through the body wall and one of these is unusually small for a mature individual, only 17.5 mm. long. Barbour's (1937) check list does not include Antigua in the list of islands inhabited by *E. martinicensis* but Parker (1933) and Dunn (1934) cite specimens in the British Museum and in the American Museum of Natural History so this species is clearly not a new introduction.

Sphaerodactylus elegantulus Barbour

Thirty-eight specimens, 17 males, 14 females and 7 juveniles, were collected. Three of these are from Fort James. All the others were taken by turning trash in a stand of cocoanuts just off the beach beside the driving road on Halsetde Bay, south-west coast, a half-mile west of Crab Hill Village. The males have a mean snout-vent length of 27.5 mm. with a range of 25.0 to 29.0 mm.; the females average 26.5 mm. and range from 24.0 to 29.0 mm. The tail length seems to differ in the two sexes more significantly than does the body length. Males have a mean tail length of 29.0 mm. (range 26.0-31.0); females show a mean of 25.5 mm. (range 21.0-30.0). The juveniles range from 13.0 to 18.5 mm. in snout-vent length.

Barbour (1921) pointed out that his original description of this species (Barbour, 1917) was based on a very young specimen and that the juvenile color pattern is quite different from that of the adult. The young type specimen is described as being mahogany brown, with the head lighter than the body, and with narrow white crossbands, four on the body and four on the tail. Adults are described (on the basis of 5 specimens obtained from English Harbour in 1918) as: males plain uniform brown; females speckled, pepper and salt.

In the present series all males except one have plain dark brown backs although most show some speckling on the dorsal sides of the head, limbs and tail. The one exceptional individual, a full-grown specimen with a snout-vent length of 25.0 mm., has the definite bands of the "juvenile pattern." Among the females 9 have a speckled pattern on the back while 5 are plain just like the males. Only three of the juveniles show the banded pattern while 4, one of which is the smallest specimen obtained, have no banding whatever. In life, both sexes had the throat tinged with yellow and the bands of those specimens which showed banding were also yellowish. Several of the specimens have a prominent lump in the skin, usually near the base of the fore-limb, apparently due to some parasite.

It may be useful to point out that in Barbour's (1921) discussion of this species the figure given for the snout-vent length of the adult (54 mm.) is clearly in error and refers instead to *total* length.

Anolis antiquae (Barbour)

Eleven specimens, 4 males, 6 females and one juvenile, were taken

from the following localities: St. John's, one half mile west of Crab Hill Village, Shirley Heights, Boggy Peak, Fort James. The males range in total length from 174.0 mm. to 198.0 mm.; snout-vent length 67.0 mm. to 89.0 mm. The females range from 131.5 mm. to 149.0 mm.; snout-vent length 49.0 mm. to 60.0 mm. In life the males are usually bright green with prominent canary yellow "spectacles" around the eyes. A light stripe runs backward from the axilla half-way to the groin. The fan is dusky gray with an orange tinge. After capture and confinement the animal may assume a uniform dark brown over the whole body including the area around the eyes. In this color phase some specimens exhibit dark comma-shaped markings above each fore-leg. Females have the back and sides light green, shading to cream on the belly, the head and throat mottled with grey and cream. These too tend to become uniform dark brown when captured.

Barbour (1937) regards *A. antiquae* as mainly arboreal. I saw many specimens in trees but the species was also abundant on the rock walls of the ruins of the old military establishment at Shirley Heights where there are almost no trees at all.

Anolis wattsi Boulenger

Seven specimens, 2 males and 5 females, were taken at the following localities: one half mile west of Crab Hill Village, near Old Road Town, near All Saints, Boggy Peak. The males measure 83.5 mm. and 96.5 mm. in total length; snout-vent, 32.0 mm. and 46.5 mm. The females range from 98.0 mm. to 112.0 mm. in total length; snout-vent length, 37.0 to 41.5 mm. In life the males are light brown on the back shading to greenish on the sides and belly; the fan is pale orange with a yellow border and the lower jaw is pale orange. Females are darker brown with a light middorsal line and hour-glass markings of dark velvety brown across the back; a light tan stripe runs from axilla to groin; the belly is an iridescent cream color and the throat is gray with three pairs of longitudinal dark lines. This species is readily distinguished from *A. antiquae* by the fact that the ventral scales are keeled in *A. wattsi*.

Ameiva griswoldi Barbour

A juvenile specimen (total length: 112.0 mm., snout-vent length 48.0 mm.) was collected in Nelson's Dockyard at English Harbour. Many large adults were seen on the grounds of the Cathedral at St. John's.

Typhlops sp.

A single specimen of a Typhlops was found beneath a stone beside the trail up Boggy Peak at an elevation of about 800 feet.

The classification of Lesser Antillean Typhlops is in a most confused state and I therefore make an attempt to give a specific name for the Antiguan form. Parker (1933), after reviewing data on Typhlops from Jamaica, Puerto Rico, Montserrat, St. Thomas, and Antigua, concludes that, until the average scale counts characteristic of specimens from each island are more firmly established by study of more material, it is best to use the name *T. jamaicensis* for all and simply specify the island of origin in each case. Ruthven and Gaige (1935) also emphasize the need for more study material and point out that Parker's figures for the middorsal scales of 5 specimens from Antigua range from 346-348 while three specimens available to them show scale counts of 331-342. The

Antigua Typhlops has sometimes been referred to *T. dominicana* Stejneger of Dominica and Guadeloupe but, as Cochran (1924) has pointed out, this species is characterized by a much larger scale count (400-440) and also has 24 rows of scales around the anterior portion of the body. The few Antiguan specimens which have been reported all seem to resemble the Jamaican species in having 22 scale rows.

Data for the present specimen are as follows: total length 125.0 mm.; tail from vent 2.4 mm.; width of tail 2.5 mm.; width of body 3.2 mm.; width of head 2.6 mm.; scale rows around anterior portion of body 22; scale rows around middle of body 22; scale rows around posterior portion of body 20; middorsal scale count, from rostral to spine, 343; midventral scale count 335.

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Notes on a Collection of Amphibians From Banes, Oriente, Cuba

By W. Gardner Lynn

A small collection of amphibians taken by Major Chapman Grant at Banes, Oriente, Cuba, 16-23 April, 1956, is worthy of note since it contains, in addition to examples of several common Cuban species, a series of very well-preserved specimens of the small *Eleutherodactylus varleyi* and a rather unusual specimen of the toad, *Bufo peltacephalus*. Banes is situated on Nipe Bay on the northern coast and near the eastern end of the island. All of the specimens reported here have been deposited in the United States National Museum.

Barbour and Ramsden's (1919) "Herpetology of Cuba" forms the foundation for any study of Cuban material and the later literature concerning Cuban herpetology has recently been cited by Schwartz and Ogren (1956). One brief paper which may be added to their list is of special interest in connection with the present collection since it deals with

eastern Cuba. This is Alayo's (1951) annotated list of 5 species of amphibians and 33 species of reptiles found in the vicinity of Santiago de Cuba.

Bufo peltacephalus Tschudi

Three adult specimens were taken. These have snout-vent lengths of 121.0, 123.0, and 126.0 mm. In this species the supraorbital crest ends anteriorly in a prominent knob and is separated from the canthal crest by a very definite gap. One specimen in this collection shows no signs of either the knob or the gap, the canthal crest meeting the supraorbital with no interruption. Examination of a considerable series of *B. peltacephalus* from various parts of Cuba has revealed no other specimens in which this is the case although it is clear that the prominence of the terminal knob does vary to some extent. This is such an obvious feature that the specimen under discussion appears, at first glance, to represent a quite distinct form. The other cranial crests are like those of normal *peltacephalus* however and except for having rather small paratoid glands, the specimen agrees with *peltacephalus* in other characters. Variations in the conformation of the cranial crests are known to occur in Bufo and it appears that this must be considered as an extreme example of such a variation.

Hyla septentrionalis Boulenger

Seven examples, 5 males and 2 females, represent this species. The males (snout-vent length 50.5 and 51.0 mm.) are adults and both show the rugosities which appear during the breeding season. Three of the females (measuring 73.0, 74.0 and 75.0 mm.) are adults with well-developed ovarian eggs. The other two (57.0 and 64.5 mm.) have no mature eggs.

Eleutherodactylus ricordi planirostris (Cope)

Five specimens were collected. Four of these have a color pattern characterized by lateral light stripes. The snout-vent measurements are: 17.0, 17.0, 18.0, 24.5, and 29.5 mm., the two last representing females with large ovarian eggs. The last measurement is, in my experience, unusually large for this species. In fact, in collecting large numbers of *E. r. planirostris* in Jamaica I have seen none over 26.0 mm. However Goin (1947) has remarked upon the large size attained by this frog in Cuba and has recorded specimens from San Diego de los Baños, Piñar del Río, measuring in the neighborhood of 32.0 mm.

Eleutherodactylus varleyi Dunn

Nineteen specimens of this tiny frog make possible some observations concerning variation in this species. Dunn's (1925) original diagnosis of *E. varleyi* gives the length as 14.0 mm. and a later paper (Dunn, 1926) gives: males, 14.0 mm.; females 17.0 mm. No well-defined color pattern is described. The localities cited are: Havana, La Modesta, Matanzas, Soledad, and Santiago. *E. varleyi* is a stout-bodied frog with short legs, a markedly rugose belly, and with the vomerine teeth in two series of moderate length extending laterally to the level of the choanae. All the specimens in this collection agree closely in body proportions. The snout-vent length ranges from 13.5 to 18.5 mm. with a mean of 14.9 mm. Four females with large ovarian eggs range from 15.0 to 17.0 mm. Means and ranges (in millimeters) for other measurements of the 19 specimens are: width of head 4.5 (4.0-5.5); tip of snout to posterior edge

of tympanum 4.3 (3.5-5.5); diameter of eye 1.6 (1.0-2.0); forelimb, from axilla to tip of longest finger 8.0 (6.0-9.0); hind limb, from vent to tip of longest toe 20.4 (18.0-23.0); femur 5.8 (4.5-7.5); tibia 6.1 (4.5-6.5). The heels do not meet when the legs are flexed with the femora held at right angles to the body and they reach only to the posterior border of the tympanum when the hind limbs are extended along the body. All adult males have an external vocal sac extending across the throat and onto the chest as noted in Dunn's description.

The present series shows two different color patterns. The predominant one, present in 15 of the 19 specimens, is very distinctive and remarkably uniform. It may be described as follows: dorsum coffee brown with two lateral lines of fawn color from eye to groin; an interocular bar of seal brown between the scapulae; an irregular blotch of seal brown midway between fore and hind limbs; a seal brown line over the tympanum; glandular dorsolateral line, seal brown; a thin middorsal light line extending forward from the vent about one-fourth the length of the body; similar light lines diverging from the vent along the posterior surfaces of the thighs; hind limbs with well-marked alternating blotches of coffee brown and fawn on the dorsal surfaces; fore limb unmarked white from axilla to elbow; throat and belly unspotted white; palms of hands and soles of feet dark. Specimens showing this pattern correspond in all details, the only variation observed being in the length of the thin middorsal light line which may extend as far forward as midbody. The four specimens which do not have this pattern are almost unmarked. The whole dorsum is coffee brown with neither lateral light stripes nor mid-dorsal stripe. Other markings, except for the dark line over the tympanum, are either lacking or very indistinct.

These specimens were taken on the ground and Major Grant found that this frog formed a part of the diet of Dromicus. Judging from the size of the eggs in the ovaries of some specimens the species was breeding in April but the breeding season may, of course, extend over a long period as it does in many lowland species of *Eleutherodactylus*. Dissection of some of the females indicates that the number of eggs laid is very small; not more than two fully developed eggs are present in each ovary.

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A New *Plethodon* From Virginia

By GORDON R. THUROW

In 1954 it was noted that a series of salamanders from Bedford County, Virginia, represented a form other than *Plethodon huldae** Grobman as labeled. These specimens appeared clearly different from all small eastern Plethodon (Grobman, 1944, Ann. N. Y. Acad. Sci., 45: 261-316) with the possible exception of *P. nettingi* Green. A study of photographs comparing dorsal and ventral views of preserved specimens of all the species and subspecies described through 1956, except *P. cinereus serratus* and *P. c. polycentratus,* confirmed this. Since these seven partly shrunken specimens were not satisfactorily separable from a series of *P. nettingi,* they were described and listed as a range extension of that form, with the note that living specimens might show subspecific differences (Thurow, 1955, Herpetologica, 11:102-103).

Two attempts to collect live material failed. Thanks to Richard Highton who pointed out an error in the locality, a third attempt was successful and revealed that the form is new, though apparently closely related to *P. nettingi.* Mr. Highton had also collected specimens of the new form, but since I had first reported and studied the form I feel free to describe it here.

Mr. Leslie Hubricht has collected not only the specimens which led to the discovery of this entity (CNHM 60512-18), but much other salamander material. I would like to acknowledge the debt that workers in this field owe him, by calling the species:

Plethodon hubrichti, sp. nov.

Diagnosis. A small black slender *Plethodon* somewhat similar to *P. nettingi* except that the body and tail are slightly more elongated in relation to the head, and a greater size is reached; the average costal groove count is 19 rather than 18, using the long count and including all dorsal forks; the dorsal metallic pigment is more abundant and forms spots, blotches, or a roughly continuous band, rather than a flecking or lacy mottling of thinner blotches; the belly, gular, and lower flanks are more uniformly dark.

Holotype. GRT 1221 (to be deposited at the United States National Museum), an adult male, collected by the Blue Ridge Parkway at about 3100 feet, 0.9 miles south of cement milepost 80 and a sign reading "View of Black Rock Hill," in Bedford County near the Bedford-Botetourt line and roughly 10 miles ESE of Buchanan, Virginia. Collected by Gordon R. Thurow on December 9, 1956.

Paratypes. GRT 1222-9 collected with the Type, and CNHM 60512-18 collected by Leslie Hubricht, September 10, 1949, all topotypes.

Range. CNHM 93317 is apparently *P. hubrichti.* It was taken in a "Ravine Head" in "Jefferson Forest" near "Greenlee," Virginia, on

*This author was aware that *huldae* and *cinereus* are not separate in 1951. A synonymizing manuscript was submitted between two similar MSS to the same journal (Muchmore, 1955, Copeia: 170-172 and Rabb, 1955, Copeia: 261-262), but it was not published.

July 30, 1943. This town is (or was) in southern Rockbridge County, along the Norfolk & Western R.R., according to postal directories and U. S. Geodetic Surveys. The locality is apparently also associated with the general Peaks of Otter-Thunder Ridge mountain mass, but lies farther northeast, in the James River drainage. The type locality is on the south side of the mountain crest, at the margin of the Roanoke River drainage. The known range is limited to these two localities. Habitat data and other collecting indicate that *hubrichti* does not occur generally throughout this section of the Blue Ridge.

Description of the Type. Measurements (in mm. from preserved animal): total length 118; snout to posterior edge of hindlimbs 49, tail from thence 69; snout to anterior edge of vent 51½; snout to posterior edge of vent 54½; greatest body width, at 12th costal groove, 6.8; greatest body height, same place, 6.0; greatest tail width, at posterior margin of hindlimbs, 5.6; greatest tail height, same place, 5.6; tail width at posterior margin of vent, 5.0; tail height at same place, 4.7; axilla to groin, 32.0; snout to anterior surface of forelimb at body, 13.7; snout to gular fold, 10.4; greatest head width 7.0; interorbital distance, 3.8; eye opening, measured from anterior to posterior eye corners, 1.5; anterior eye corner to posterior edge of nostril, 1.7; anterior eye corner to tip of snout, 2.3; upper eyelid width, 1.4; fore limb, measured from juncture with body to tip of longest toe, 9.4; hind limb, similarly measured, 11.9; fore foot, measured from carpal-metacarpal junction, 2.4; hind foot, measured from tarsal-metatarsal junction, 3.4; longest finger, measured from edge of webbing between toes, 1.2; longest toe, similarly measured, 2.0.

Other structural characters (some under low magnification): Body and tail slender and elongate; body and tail base rounded, slightly flattened and with median dorsal impressed line. Tail round and tapering very gradually from behind vent to near tail tip, where tail cross-section becomes vertically oval. Triangular skull and rectangular branchial area posteriorly making up the "head," as in other *Plethodon*, widest just behind the eyes at angle of mouth. Costal grooves 19, counting one at axilla and groin, but last two converging ventrally so that 18th costal interspace wedge-shaped; costal interspaces between adpressed limbs 7; similar furrows on tail. Well-defined upwardly convex postorbital grooves passing back to intersect lateral margins of gular fold, met by a vertical groove behind each mouth angle. A fainter groove extending forward from eye to end in a fork just posterior to nares. Upper jaw edge concave from the side. Limbs moderately developed as in *P. nettingi*. Toes slightly webbed at base, to about one phalanx; 1-4-2-3 and 1-5-2-4-3 in order of increasing length, phalangeal formulae normal. Tongue rounded but narrower anteriorly, broadly filling floor of mouth, attached medially but free all around except anteriorly; narrow plicae radiating from a point a little behind the center and almost reaching thin smooth margins. Vomerine teeth 6-6, in two rows curving inward and backward from behind outer edge of internal nares; rows separated by about 1½ width of internal naris, and from parasphenoids by about 2 widths of naris; parasphenoids in an elongate patch beginning about at middle of eye socket but toward back of external eye opening; patch narrower anteriorly and constricted about half way back as in other

Plethodon; tooth reduction along midline resulting in partial division into two patches. No hypertrophy of premaxillary teeth. Snout swollen along nasolabial groove, with small tubercle at bottom of groove; large but poorly defined mental gland area; larger hedonic gland openings clustered around the vent, and along part of tail ventrum though inconspicuous there; a few smaller ones scattered on belly and pectoral area. Anterior part of vent papillate and with small shallow transverse grooves in margins; posterior margins smooth, glandular, and met by two converging grooves at posterior vent angle, so that two small, blunt, partly free lobes are formed.

Coloration: General body color black above and on most of tail ventrum, in turn slightly lighter medially. Belly dark slate gray, shading to black at level of limbs. Gular slightly lighter gray, mental gland area appearing dull gray-white through further melanophore reduction. No pigment in margin of gular fold and at limb joints, ventrally. Body with purplish reflections in life due to blood and visceral pigments. Abundant dorsal golden pigment forming large closely clustered blotches covering skull and extending backward, roughly approximating a band, to two-thirds length of tail (which may be regenerated posteriorly). A scattering of a few small white spots on the uper cheek and flanks, at about level of dorsal margin of limb insertions, remaining after fading of pigment in preservative (because they are underlain by small gaps in the black pigment). A few such spots scattered on dorsum, among golden pigment, more numerous on head and base of tail. A few very minute melanophore gaps scattered on the lower flanks, essentially invisible except under magnification. Eye black, with gold pigment on iris all around pupil.

Variation. Table I shows some of the variation encountered. "Body" length is from the snout to the posterior margin of the hind limbs. Costal grooves "19-" indicates a ventral narrowing of the 18th interspace; "18½" means that the 19th groove joins with the 18th, about half way down, as a fork; "18½+1" means that a little extra space occurs behind this, though not a full interspace. "Adp. F." refers to the number of costal folds or interspaces between adpressed limbs. In addition to vomerine variation, there is a varying division of the parasphenoid teeth into two patches. Under "Dorsal gold pigment," "Blotch" equals a mass of heavy blotching; "Reduced" equals reduced total pigment and smaller blotches; and "Band" equals an increase to a fairly solid mass or irregular band of pigment. 'Dorsal white spots" are rated against the type description: "-" is less, just a few spots; "+" is heavier spotting; and 1228 may have none. "Gular gaps" refer to breaks in the melanophore rate of the gular and just anterior to the fore limbs. In aberrant 1227, at least, some guanophore pigment filled these gaps in life. They were rated 1-4: "1" is no gaps, or just a few minute ones; "2" a few scattered small gaps, "3", moderate numbers of small gaps all over the gular; and "4," scattered large gaps. "Flank white spots" refers to the total number of small white spots (which in this species appear displaced upward to the middle and upper flanks and upper cheeks), and still smaller unpigmented spots below. The number of plus marks refers to

Table 1. Variation in *P. hubrichti*

Number	Sex	Body	Total	Costal Gr. (L/R)	Adp. F.	Vom. (L/R)	Dorsal gold pigment	Dorsal white spots	Gular gaps	Flank white spots
GRT 1221	(T)M	49	118	19–/19–	7	6/6	Blotch	As desc.	1	++
1222	M	49	113	19–/19–	7	2/7	Blotch	—	2	++
1223	M	42	96	18½/18½	6	6/6	Reduced	+	1	+
1224	F	48	tail-R	18½/18½	6½	6/8	Blotch	+	3	+++
1225	IMM.	34	tail-R	18½/18½	5½	6/6	Band	—	2	+++
1226	F	46	104	18½+1/18½+1	6½	7/7	Blotch	—	1	"0"
1227	F	42	99	18½/18½	6	6/6	Reduced	+	4	+++
1228	F	47	117	18½/18½	6½	6/6	Band	0?	1	"0"
CNHM60512	F	41	99	18½/18½+1	5	7/6				
60513	M	43	"96"(R)	19–/19–	6	5/5				
60514	M	42	96	17½+½/18	5½	7/5				
60515	F?	38	84	19–/19–	6	6/6				
60516	F?	39	87	18½/19–	6	5/5				
60517	IMM.	28	58	18½/18½	4½					
60518	JUV.	13.2	24	"18?"						
93317	IMM.	28	61	18½/18½						

the relative abundance of all these small spots, which never become really numerous or conspicuous.

Sexual variation is similar to that in other small *Plethodon*. The snout appears rounded in females because the nasolabial groove area is not swollen, and there is no small tubercle at its lower end. There is no mental gland and ventral hedonic gland development. The vent is a simple slit, with pleated edges and no papillae. Measurements show no definite proportion differences, though slight differences could exist. The female torso sometimes tends to be slightly bulkier, perhaps because of ova, which makes the head seem relatively smaller. The only pigmentation difference noted is that the gular is not made lighter by the effect of the mental gland. In female GRT 1228 the gular is hardly lighter than the belly. No sexual dimorphism was noted in the teeth, or in other mouth characters. In general, sexual dimorphism is more marked in many other species of *Plethodon*.

Age variation involves several characters. The growth of the head width, hind leg length, snout-fore limb length, head and body length, and tail length increase in that order, so these dimensions become larger in larger animals. They also become relatively larger, although some ratios change very slightly. The increase in costal interspaces between adpressed limbs in larger animals is similarly due to a faster increase in the axillary-groin distance than in the sum of the front and hind limb lengths. Vomerine tooth counts are not correlated with age in this material. Sexual characters become more pronounced with age, even after sexual maturity, which occurs somewhere near a length of 38 mm. (preserved, 40 live) from snout to posterior margin of the hind limbs. Pigmentation changes involve ventral lightening in juveniles, particularly on the gular, and the pigmentation may be incomplete. Although variation in the development of discrete gular gaps is largely individual, these tend to occur more frequently in juveniles. The smallest live specimen (GRT 1225) not only had a more solid band of metallic pigment than

6/7 of the others, but it was a darker, copper color, rather than gold.

Seasonal variation involves the sexual characters. The ventral hedonic glands of the fall CNHM specimens are more enlarged and more noticeable on the tail ventrum than in the winter GRT specimens.

Type locality and habitat. The type locality differs strikingly from the surrounding dry oak and pine covered slopes. It is a flat valley-head, where seepage rises in many spring holes and forms a winding stream, and the water level is but a few inches below the surface. This hollow, which is almost a swamp, contains a grove of *Rhododendron maximum.* Hemlocks, *Tsuga canadensis,* grow along the water course in the form of both large trees which survived earlier lumbering operations and some seedlings and young trees. Large rotten logs and smaller dry bits of scrap lumber remain from the lumbering. Scattered yellow birch, *Betula lutea,* also occur here, although many are dead, especially around the margins of the area.

The weather had been mild and damp for about a week, but was clear and getting colder. Air was 48°F at chest height towards the edge of the grove, at 3 P.M. At first the *Plethodon* were sought unsuccessfully in the wettest terrestrial conditions, inside large rotted logs, and under rocks and debris near water level. Then they were found on the higher ground around the margin of the wettest area, under small logs and scraps of lumber, most or all of it hemlock. Moisture could be squeezed from some of this wood. The temperature under one log harboring a *Plethodon* was 46°F. There is probably never much of a herbaceous stratum under the *Rhododendron,* and the inch or two of dead leaf cover is mixed *Rhododendron* and Oak.

P. hubrichti was the only salamander found in the area, although *P. cinereus, P. glutinosus, Eurycea bislineata,* and *Desmognathus monticola* were taken a few miles south along the mountain.

Habitat data accompanying the Greenlee specimen merely mention "oak-chestnut" and "ravine head."

Habits and tolerances. These animals were under the same kind of cover as *P. cinereus* and *P. welleri* I have collected, and usually reacted in the same way when exposed, attempting to enter cavities or worm into debris, or quietly to crawl under the leaf mat on the side. One was found in a watch-spring coil in a small hollow under a log, and another snapped into this coil, belly up with the head buried, when picked up in the palm. They apparently occupy the usual *Plethodon* ecological niche—as a sub-forest floor secondary carnivore, eating almost any small invertebrate on the basis of availability. Some show tail amputation and other predation scars.

Later it was noticed that the tail is semi-prehensile, in that it curves into a hook over a finger and can support the animal's weight. Mittleman discusses this quality as being associated with *P. glutinosus chlorobryonis* (1951, Herpetologica, 7:105-112), but this does not have the significance he attributed to it since myself and others (Gaines, 1895, Amer. Nat., 29: 53-56) have noted the same characteristic in several other parts of the *glutinosus* range, and in other *Plethodon* such as the mountain-inhabiting *hubrichti.* It probably occurs in many *Plethodon.*

Observations on the relative tolerances of *hubrichti* and *cinereus* were

made in a simple experiment. Three *hubrichti* and three West Virginia *cinereus* were kept in a cool (10-16.7°C) closet for three days after examination under chlorotone, and then placed in dry cloth-covered quart jars in front of a heater with a fan. This faced the jars for alternate periods, which made conditions increasingly severe, step fashion. A thermometer between the jars gave an index of relative temperature change (going from about 15° to as high as 43°C). The condition of the salamanders roughly indicated their degree of dehydration and anoxia.

The experiment was terminated after 70 minutes to prevent damage to the paratypes, and all animals were dropped into a pan of shallow water which soon cooled from 20½ to 18°C. In the first jar, *hubrichti* 1228 was dead, but the two *cinereus* swam, crawled, climbed, and raised their heads. All animals in the other jar also recovered (1226, 1227 and one *cinereus*), moving before being put in the water, though the *cinereus* had appeared to collapse temporarily at one stage of the experiment.

Too few animals were used for any definite conclusions, but the observations made suggest that *cinereus* is perhaps more resistant to increasing warmth and evaporation rates, as might be expected from its range and habitat.

Comparisons and relationships. P. hubrichti is easily distinguished from the eastern Large Plethodons (Grobman, 1944, op. cit.) by its size, proportions and costal groove count—and from many additional *Plethodon* by its total lack of any red pigment and any trace of a band-shaped break in the dorsal melanophore layer.

P. elongatus and *P. neomexicanus* both reach a larger size than *hubrichti,* and have a shorter tail and shorter legs relative to body length, so that the leg/body ratio is more noticeably different from the snout-forelimb/body ratio*. *P. neomexicanus* has a generally lighter pigmentation and lacks one phalanx on the fifth toe; *elongatus* has a lower costal groove count and usually shows some trace of a band. Other differences exist, especially in life.

Those *P. cinereus* and *P. dorsalis* lacking a dorsal band and visible red pigment may be distinguished from *hubrichti* by their mottled bellies and lower flanks. They are smaller, particularly *dorsalis,* and in larger specimens of both the hind legs, at least, are slightly shorter relative to body length. Other differences, such as less dorsal metallic pigment and a more discrete mental gland, are clearer in life.

P. welleri is similar to *hubrichti,* particularly in pigmentation, but it

*Such taxonomic differences become less pronounced in younger animals. The hind limbs of *richmondi* are smaller, and shorter in relation to body and snout-forelimb length. The belly and lower flanks are more immaculately black in *hubrichti.* Most *richmondi* material I have seen from Indiana, Ohio, Pennsylvania, West Virginia, Virginia, Kentucky, Tennessee, and North Carolina show varying development of small white spots on the belly and lower flanks. This usually does not give the "salt and pepper" appearance of *cinereus,* though, and some West Virginia and Virginia populations in particular have nearly immaculate bellies. Some *richmondi* have traces of a dorsal band. In live material the heavy dorsal blotching of *hubrichti* contrasts with the scattered flecking of *richmondi.*

reaches a smaller maximum body size, and the relative tail length is less. It usually has two full costal interspaces less, averaging 16 costal grooves, and there are other differences, particularly in *P. w. ventromaculatum.*

P. richmondi differs in the other direction, most having more than 19 costal grooves, and nearly all possessing more than 17 full sized interspaces, as in *hubrichti.* Among larger specimens, the relative tail length is less in *richmondi,* through greater relative body growth than in *hubrichti,* rather than less tail growth as in *welleri* or *dorsalis.*

P. nettingi may be subspecifically related to *richmondi,* as proposed by Highton and Grobman (1956, Herpetologica, 12:185-188). However, other species of *Plethodon* are allopatric and show some morphological overlap, and for the moment I prefer *"P. nettingi"* until more detailed evidence is presented.

This form is the most difficult to separate sharply from *hubrichti* as indicated above and earlier (1955, *op. cit.*), and these two allopatric forms show morphological overlap in the majority of characters. *P. hubrichti* appears quite distinct in the field, but one is not so sure when it is compared with live *nettingi* in the laboratory. Measurements from the 16 *hubrichti* comparing head width, hind leg length, snout-forelimb length, and tail length with body length, were made into regressions and compared with similar *nettingi* regressions. They could not be clearly separated. *P. hubrichti* attains a larger body size, however, and since tail growth is fastest and body length next so, adult samples look more elongate on the average, and have a higher average number of costal interspaces between adpressed limbs. *P. nettingi* varies from 16 total interspaces plus an incomplete one, to 17 spaces plus an incomplete one, and the latter condition is characteristic of *hubrichti.* Comparison of live and freshly preserved material confirms that there are no clear differences in mouth or secondary sexual characters. Some *hubrichti* do have light pigment gaps on the gular and belly which are as well developed as in some *nettingi.* Dorsal guanophores in some *nettingi* are not scattered specks, but tend to group together into a train of dorsal blotches on each side of the median impressed line, fusing on the tail. This is only quantitatively different from *hubrichti,* and is approached by some. Their reduced quantities of guanophores tend to be more clustered, though, and most live *hubrichti* and *nettingi* can be distinguished at a glance.

These two forms also show habitat overlap. Though Brooks (1948, Copeia: 239-244) says *nettingi* appears to be limited to forests dominated by red spruce, Green (1938, Ann. Carnegie Mus., 27: 295-299) says most of his specimens were taken in cool, shady ravines containing *Tsuga canadensis, Betula lutea,* and *Rhododendron maximum.* This latter fairly well characterizes the *hubrichti* type locality.

It seems quite possible that *nettingi* and *hubrichti,* are both remnants of one larger species population which existed in a cooler climate during the Pleistocene. They are geographically isolated now, by the Great Valley, but it is not known whether internal isolating factors have developed. Although they could yet be proven subspecies, definite differences exist, and it seems best to call them species at this time. *P. welleri* also shows affinities to the new form, and *welleri* and *nettingi* appear

more closely related to it than the other small *Plethodon.*

Conservation. The total *hubrichti* range may be restricted to shrinking environments in a few ravine heads on the Peaks of Otter-Thunder Ridge mountain mass. Collectors are urged to use restraint, particularly at the type locality.

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BEHAVIOR OF A CAPTIVE BLACK PINE SNAKE.—Roger Conant (1956, Am. Mus. Nov., No. 1781, pp. 1-31), in his excellent report on the Pine Snakes *Pituophis melanoleucus lodingi* Blanchard and *P. m. ruthveni* Stull, states that "three examples of *lodingi* that have been exhibited at the Philadelphia Zoo were all quite docile, seldom even hissing when handled," and that specimens of *ruthveni* collected by Fitch and Mansueti made no attempt to bite.

One of the specimens examined by Conant (MSC 55-1, from Forrest County, Mississippi, 7 miles South of Hattiesburg) was in my possession from the date of capture on April 15, 1953, until it was killed and preserved some 8 or 10 weeks later. The snake was attacked by a dog during the capture and severely wounded several inches behind the neck region. The wound was initially treated with an iodine solution and received no further care; it healed without complication. The snake was meanwhile housed in a screen cage.

Possibly as a result of the rough treatment, this snake was from the beginning unusually vicious, hissing and striking repeatedly whenever the cage was approached. During the following weeks, no appreciable change in the behavior could be detected. Constant striking against the screen wore away the skin and tissue of the rostral area until the bone was exposed. It was to prevent further disfiguration of an otherwise almost perfect specimen that the snake was finally killed. Perhaps the pain of the abraded rostral further added to the irritable disposition of this serpent.

There remains the possibility that this snake, if given gentler treatment, would have responded in a more docile manner as did the other specimens cited. Perhaps such vicious behavior was not typical, but it nevertheless remained unaltered and appeared to be permanently established in this specimen.—*J. William Cliburn, Division of Biological Sciences, Mississippi Southern College, Hattiesburg, Mississippi.*

Some Interesting Rattlesnakes From Southern British Guiana

By E. Ross Allen and Wilfred T. Neill

Comparatively little is known about the taxonomy, habits and distribution of South American rattlesnakes. The cascavel, *Crotalus durissus terrificus* (Laurenti), has been reported from Colombia, Venezuela, and the Guianas to northern Argentina, Paraguay, and southern Brazil; there may also be an Ecuadorian population. As Gloyd (1940: 133) remarked, "In consideration of the tremendous range of this snake . . . and the scanty present knowledge of the details of its distribution and variation, it is highly probable that it will be necessary to separate it into additional subspecies when sufficient material for thorough study is assembled." Klauber (1941: 333) described *C. vegrandis* on the basis of two specimens from near Uracoa, Venezuela, and also suggested (*ibid.*: 335) that there might be "a stunted race of *terrificus* in the vicinity of Mt. Roraima," near the common junction of British Guiana, Venezuela and Brazil. A small rattlesnake, *C. unicolor* van Lidth de Jeude, is known from Aruba Island, off the coast of Venezuela; it is closely related to the widespread mainland species (Gloyd, 1936: 65).

Recently, Klauber (1956: 34) reduced *vegrandis* to a subspecies of *Crotalus durissus;* and he also suggested (*ibid.*: 32, footnote 5) that *C. d. terrificus* is a composite of at least three forms: *C. d. cumanensis* Humboldt in the north, *C. d. cascavella* Wagler in the Brazilian "bulge," and *C. d. terrificus* (Laurenti) in the south. To some extent the studies of Vellard (1938, 1943) bear out Klauber's tentative suggestions. Vellard investigated geographic variation in the venom of South American rattlesnakes, with reference to neurotoxic, coagulant, hemolytic, hemorrhagic, necrotic and other effects; studies were made both *in vivo* and *in vitro.* It was found that, in rattlesnakes of the more southerly populations (Argentina, Paraguay and southeastern Brazil), the venom was highly neurotoxic, producing little hemotoxic reactions and no subsequent necrosis, whereas in the more northerly populations (Venezuela and northeastern Brazil), the venom was largely hemotoxic, drastically affecting the blood and the erythrocytes, and resulting in marked necrosis of the bitten part. Venom from Venezuela was yellow, that from northeastern Brazil pale yellow to colorless, that from southeastern Brazil colorless, that from the Paraguay-Argentina area yellow. Goncalves (1954) found a basic toxin in venom from rattlesnakes of southern Brazil and Argentina; this toxin was lacking in the venom of specimens from northern and central Brazil. Wyeth Laboratories, Inc., compared the potency of rattlesnake venom from the Colombia-British Guiana area with that from southeastern Brazil, finding the latter to be far more toxic (personal communication from B. R. Criley, dated March 4, 1955). Little is known about the taxonomic significance of geographic variation in venom; however, the variation in South American rattlesnake venom is far greater than would be expected in a taxonomically homogeneous population.

A thorough revision of South American rattlesnakes cannot be at-

tempted until more local studies are made. In this connection certain of our observations may be of interest.

In northern South America, from Colombia through the Guianas, most published locality records of the cascavel are from areas near the coast (Gloyd, 1940: Map 9), although in recent years a few museum specimens have accumulated from inland regions. In 1952, through the cooperation of Edward McTurk, we were able to secure seven rattlesnakes from southern British Guiana, and to make observations on the reptiles' habits and habitat in that portion of the continent. Six of our specimens (ERA-WTN Nos. 14372, 14383-86, and 14388) were taken in the vicinity of the McTurk homestead, which lies on the Rupununi River approximately 40 airline miles above its junction with the Illiwa, and 230 miles inland of Georgetown. Three miles to the west is Mr. McTurk's landing strip, known as Karanambu. A week was spent in this area. Some faunistic notes were made there, and additional data were provided by Mr. McTurk.

Mr. McTurk and his Macusí Indian employees stated that two kinds of rattlesnake were found in the area, a small "savanna rattlesnake" and a large "bush rattlesnake." The two were thought to be ecologically separated, as the names suggest. To some extent our observations support local opinion.

The savanna rattlesnake may be considered first. Five specimens were

Fig. 1. Larger specimen: a "bush rattlesnake" (ERA-WTN No. 14383) from Karanambu, British Guiana. Smaller specimen: a "savanna rattlesnake" (ERA-WTN No. 14372) from 3 miles east of Karanambu. Note that the rattle string is composed of subequal segments, implying maturity.

secured (Nos. 14372, 14384-86, and 14388). A description of these snakes follows: Body moderately stout. Head length contained about 22 times in total length. Ratio of tail length to total length about .104 in males, .070 in females. Fang length contained about 73 to 78 times in total length. (Fang length in this case is the straight-line distance from the tip of the fang to the junction of the fang with the maxillary bone. If lumen-to-tip measurement is used, the figures become about 79 to 84 times.)

Head subrectangular, snout blunt. Rostral subtriangular, about as wide as high, bordered by a supralabial, a prenasal, and an internasal on each side. Scales on top of head, anterior to supraoculars, including a pair of triangular internasals and a pair of larger prefrontals. Frontal area occupied anteriorly by a pair of scales in contact on midline; three smaller scales posterior to these. Posterior portion of head covered by small, ridged scales. Nasals divided; the anterior larger, the posterior containing the nostril. Two loreals on each side. Supraoculars somewhat elevated, jutting over eyes. Two preoculars, two suboculars, and two or three postoculars. Four rows of scales between supralabials and orbit.

Supralabials 12 to 15; infralabials 14 to 17, first pair divided. Mental triangular; one pair of enlarged genials in contact on midline. Ventrals 170-172 in males, 177-178 in females. Subcaudals 29-31 in males, 21-23 in females. Scale rows 29-29-21, 29-31-21, or 29-29-20.

No. 14372, a male, measures 680 mm. in total length. The incomplete rattle of this specimen consists of 6 equal segments. No. 14384, also a male, measures 898 mm.; the incomplete rattle consists of 10 segments, the proximal 4 of which are of equal size. No. 14385, a female, measures 923 mm.; the incomplete rattle is composed of 11 segments, the proximal 7 of which are of equal size.

Ground color of body (in life) light greenish-gray anteriorly, darkening to dull brown posteriorly. Sides speckled with yellow-, gray-, and ivory-tipped scales which do not obscure the pattern. Dorsum with about 25 diamond-shaped blotches, the last 7 or 8 more or less obscure. Anterior blotches sharply defined, deep brownish-black with conspicuous light grayish-brown centers, and bordered by yellow- or white-tipped scales. Lateral blotches deep brownish-black, bordered by many conspicuous white-tipped scales. Dorsal blotches not confluent with lateral ones. Neck with dark and light stripes as follows (in order down the side from the vertebral stripe): (1) A grayish-brown vertebral stripe involving one scale row; (2) a yellow stripe on one scale row; (3) a deep blackish-brown stripe covering two scale rows; (4) a yellow stripe on one scale row; (5) a black stripe on one scale row; (6) a yellowish-white stripe on one scale row. Stripe (2) may be grayish-brown and therefore indistinguishable from (1). Stripe (5) may be broken into spots. Stripe (6) may be dull and scarcely distinguishable from the ground color. There may be a row of dark spots below (6), suggesting a 7th stripe. The stripes extend back on the neck a distance of 4 or 5 head lengths. Head with an elaborate pattern of black, brown, and yellow markings (see Fig. 2). Tail blackish above, slightly lighter below, without crossbands (a vague trace of bands in one specimen). Ground color of venter ivory. Most of the ventral scutes with a white spot at each end, the spot bordered

internally by a gray blotch. Rattle dark brown except for basal segment, which is black. Iris pale yellow, clouded centrally with grayish-brown; pupil with a very narrow border of bright yellow. Tongue grayish-black proximally, becoming light gray toward the fork.

In summary, the savanna rattlesnake might be characterized as follows: A rattlesnake of the *durissus* group, with a distinct pattern of dorsal rhombs and a low spinal ridge. Size rather small; adults two to three feet in length. An elaborate, sharply defined head pattern, including a white or yellow V-shaped mark on the supraoculars. Dorsal rhombs not confluent with lateral spots. Neck with a large number of dark and light stripes, as described above. Individual scales seldom uniform in color, many tipped with ivory, yellow or light gray, others with dark brown. Tail uniform blackish, with little or no trace of crossbands. Fangs proportionately very long.

Clearly the savanna rattlesnake differs from *Crotalus durissus terrificus*, as the latter form is usually described. For example, according to Gloyd (1940: 133-134), in *terrificus* the head pattern is faint or obsolete; the paravertebral stripes may be lacking; the center of each body blotch usually is not conspicuously lighter than the border; the maximum size is in excess of four feet and perhaps over five feet; the scales of the body are for the most part unicolor; the dorsal blotches are often confluent with the lateral dark spots; the tail is marked with crossbands except in old adults; etc. (This description evidently was based largely on Brazilian specimens, for Gloyd (*op cit.*: 139) subsequently mentioned the distinct head markings and light-centered body blotches of Colombian, Venezuelan, and Guianan cascavels.) Cochran (1943: 12) said of South American *terrificus*, "Its length is up to 7 feet." Examples of *terrificus*, figured by Amaral (1926: pls. 1-3), Ditmars (1930: fig. 43), Klauber (1936: fig. 75), and others, do not especially resemble the savanna rattlesnake. Most published photographs and descriptions seem to be of Brazilian snakes.

Interesting observations were made on the habitat and habits of the savanna rattlesnake. The McTurk homestead is on an "island" formed by the Rupununi River and an abandoned channel of that stream. The island itself has been cleared, and supports only a scrubby second growth. The country about the island is grassland, the so-called Rupununi Savanna; it is relatively dry as compared with most tropical savannas. During the rainy season the region is flooded, but many knolls, ofttimes rocky, project above the general ground level and are never inundated. When the rains come, the savanna rattlesnakes find refuge on these knolls. They also appear on the McTurk homestead, which at that season is truly an island. There many are killed or captured each year by Mr. McTurk's Macusí Indian employees.

The higher knolls of the savanna are dotted with conical termite hills, many of them eight or nine feet high. During the rainy season, ground water softens these hills, and then they are commonly dug into by armadillos, anteaters, and agoutis. With the advent of dry weather, the material of the termite hills hardens almost to the consistency of concrete, and the mammal burrows therein provide residences for the savanna rattlesnake.

During the dry season the rattlesnakes are almost entirely confined to the termite hills, although a few specimens are said to frequent ground burrows elsewhere. During the rainy season they hide under logs and litter on higher knolls. They were found under zinc sheeting and piles of pipe about Mr. McTurk's yard.

The Macusí Indians believe that the savanna rattlesnake feeds mostly upon large, gray iguanid lizards which are commonly seen about the termite hills. However, the extreme fang length of this snake (in proportion to its size) suggests a diet of furred or feathered creatures. According to Mr. McTurk, efforts had been made to stock the Rupununi Savanna with rabbits; and the failure of these attempts was attributed to rattlesnakes.

Nothing was learned of the savanna rattlesnake's enemies except, of course, man. Mr. McTurk stated that the reptiles are thought to be less common as a result of the fires that frequently sweep over the grassland.

The savanna rattlesnake is a surprisingly docile reptile. None of our Rupununi specimens ever rattled, although they were kept alive for several months. The defense posture is unusual. When teased or cornered, the snake places its head flat on the ground, protects it by a coil of body, and conspicuously elevates but does not sound the rattle (Fig. 2). If further annoyed, the creature tucks both head and tail under several coils of the body. No specimen could be provoked into striking. Such actions contrast sharply with those often attributed to *Crotalus durissus terrificus*. The latter, while not as irascible as its ally, *C. d. durissus*, will certainly rattle and strike; Cochran (*op. cit.*: 12) stated that South American *terrificus* would attack deliberately.

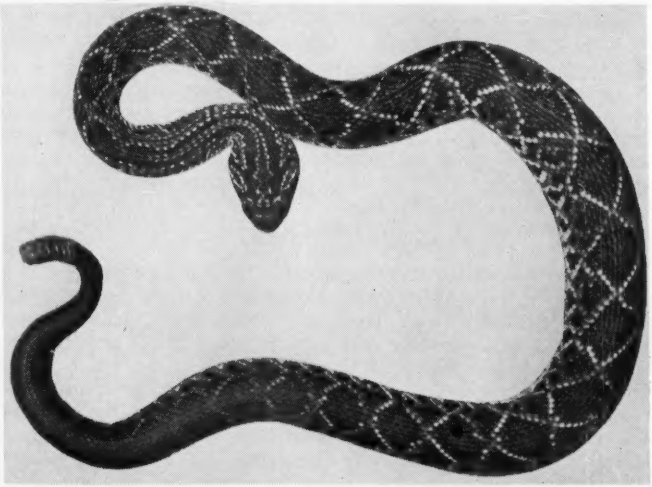

Fig. 2. Characteristic defense posture of the "savanna rattlesnake," viewed from directly above. The head is pressed to the ground and partially shielded by a coil of body; the rattle is elevated but not sounded.

Occasional savanna rattlesnakes might not be as docile as ours. Mr. McTurk stated that one of these reptiles dwelt for a long time beneath his bathroom floor and rattled when anyone entered the room. Local Indians had been bitten by rattlesnakes and had recovered. The bite was said to produce numbness of the bitten part, a feeling of drowsiness, and not much pain.

One specimen of the "bush rattlesnake" (No. 14383) was collected. It proved to be a large *Crotalus durissus terrificus,* 1442 mm. in total length. (Laurence M. Klauber, who examined our material, stated *in litt.* that this was as large a *terrificus* as he had ever seen.) In this specimen, a female, the broken rattle was composed of six equal segments. The ground color was a dull, uniform olive-gray, without light-tipped scales. The dorsal rhombs and their light borders were also dull, neither in much contrast with the ground color. The lateral dark spots were scarcely distinguishable. A head pattern was present, but was not sharply defined. There was no V-shaped mark on the supraoculars; instead, a light band extended across the head between the eyes. A neck band, slightly darker than the ground color, involved one or two scale rows; the scales just above the band were slightly lighter than the ground color. The venter was mostly white, each scute clouded anterolaterally with grayish-brown. The fang length was contained about 90 times in the snake's total length (or 98 times if lumen-to-tip measurement is used).

This bush rattlesnake is shown in an accompanying photograph (Fig. 1), along with an apparently adult savanna rattlesnake (No. 14372). In both examples the incomplete rattle is composed of equal segments, a condition indicating maturity.

The bush rattlesnake was taken in thickly wooded country bordering the savanna at Karanambu. At this locality the transition from forest to savanna is very abrupt, with practically no intergradation of biomes.

The snakes shown in Fig. 1 may well be respectively the largest and the smallest adult cascavels ever collected; they were taken at localities about three miles apart, in different habitats. It seems improbable that these two snakes could be taxonomically identical. Nevertheless, local material cannot be segregated into two lots on the basis of adult size. It will be recalled that No. 14372, a male, appeared (on the basis of rattle measurements) to be full-grown at 680 mm.; No. 14384, a male, at 898 mm.; and No. 14385, a female, at 923 mm. However, No. 14386, a female savanna rattlesnake, measures 949 mm.; it does not seem to be full-grown, for the complete rattle is composed of eight segments which become progressively larger proximally. No. 14388, another female savanna rattlesnake, measures 1031 mm.; it, too, may not be full-grown, for the incomplete rattle is composed of five segments which become slightly larger proximally. These last two specimens are quite similar to the remaining savanna rattlesnakes in characters other than size; they show no evidence of darkening or obliteration of pattern; they approach the bush rattlesnake only in bodily dimensions. No. 14386 was collected at the McTurk homestead, No. 14388 in a little-used building on the landing strip at Karanambu.

Conceivably, two races of *Crotalus durissus,* differing in adult size and other characters, meet and intergrade in the vicinity of Karanambu.

Alternatively, we must suppose that, within a single population of rattlesnakes, some individuals become full-grown at a length of about 27 inches, others at roughly 35 to 41 inches, and still others at approximately 57 inches. Either circumstance would be of considerable interest.

A male rattlesnake, No. 14387, was collected at Imbaimadai, in the Pakaraima Mountains of British Guiana, about 155 miles northwest of Karanambu. It displayed the bright "savanna" pattern, but was quite large, measuring 1296 mm. in total length. Judging from the five equal segments of the broken rattle, it is full-grown. This snake was irascible, rattling when disturbed; however, it could not be made to strike. It had a tick clinging to the edge of the pit.

The savanna rattlesnakes from Karanambu show some tendency toward *Crotalus vegrandis* in the presence of numerous light-tipped scales. This character was more evident in the three smaller specimens, and especially in No. 14384, which, in life and shortly after ecdysis, was impressively light-mottled. The light scale tips darkened rapidly after immersion in formalin. No. 14372 agrees in size with the type of *vegrandis,* the two snakes, both adult males, measuring 680 and 636 mm. respectively. On the other hand, the head and body pattern of the savanna rattlesnakes is duplicated or approached in larger specimens from coastal Colombia, Venezuela, and British Guiana, judging from the remarks of Gloyd (1940: 139).

The Macusí Indians believe in the existence of two rattlesnakes other than the "bush" and "savanna" varieties. One was stated to be greenish in ground color and to occur in the vicinity of Mt. Roraima. This statement is interesting in view of literature comments as to the possibility of a Mt. Roraima race. The other was said to be a huge rattlesnake of blackish or dusky coloration, inhabiting the country about the headwaters of the Rupununi and nearby streams. This observation, too, is of interest when one recalls that the Karanambu bush rattlesnake was large and dark. Whether or not the Macusí are correct in their beliefs, it appears that a fairly complex taxonomic situation may exist among the rattlesnakes of southern British Guiana and adjacent areas.

We are indebted to Howard Morrow for his support of the trip that yielded the interesting specimens; to Edward McTurk for many favors; and to Laurence M. Klauber for helpful information.

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ALBINO PACIFIC TREE FROGS.—Twenty-five pairs of the Pacific tree frog, *Hyla regilla Baird and Girard,* obtained on the night of April 4, 1954, were placed in separate breeding containers and allowed to spawn. One pair of frogs laid both pigmented and non-pigmented eggs at a ratio of approximately 2:1. After hatching, 72 pigmented and 36 non-pigmented tadpoles were separated and placed in two quart pyrex trays and an attempt was made to raise some of these frogs to maturity. Spoiled lettuce and fouled water decreased the numbers to 56 pigmented and 17 non-pigmented tadpoles on May 7. By May 12 it was apparent that the albinos were noticeably smaller than their pigmented siblings. The albinos did not feed but instead hid under the lettuce leaves. After the albinos were covered to protect them from direct light active feeding was observed and growth was apparent. Nine of the albino tadpoles died in May, most of them during transformation. Three more died shortly after transformation. The surviving "baby frogs" were fed *Drosophila* and were occasionally force-fed a mixture of yeast extract, liver, and cod-liver-oil. The albinos did not grow appreciably after transformation and died during the winter. We were also unable to raise the siblings to maturity.

Measurements were made of the snout-vent, head width, shank length, hand length, foot length and snout angle of the albinos, siblings and of thirty controls. Two of the albinos were very small. The other three albinos were slightly smaller than the controls which were in turn smaller than the 18 siblings which survived transformation, but the differences were not significant. No significant proportional difference in morphology accompanied the albinism.

At the time of transformation the pattern became apparent but the background remained without pigment. This would indicate a different developmental control for the background color and the pattern. The albino mutation obviously effected only the background color. Both of the parents had green background.—*David L. Jameson and Rose Marie E. Myers, Dept. Biology, University of Oregon, Eugene, Oregon.*

"ALBINISM" IN THE SALAMANDER *AMPHIUMA MEANS*.—Among 53 *Amphiuma means* Garden, taken on March 4, 6, and 11, 1955, at a locality 3.4 miles northwest of Blackville, Barnwell County, South Carolina, are five unusual, albinistic individuals.

Albinism in *Amphiuma means* has apparently been unreported. Cagle (Copeia, 1947 (3): 210) has mentioned a single albino of *Amphiuma m. tridactylum* Cuvier, taken at New Orleans, Louisiana. Hill (Tulane Stud. Zool., 1954, 1 (12)) has demonstrated that the New Orleans populations of *Amphiuma* are referrable to *Amphiuma tridactylum* and thus represent a species distinct from *A. means*, which inhabits the Atlantic and the eastern Gulf Coastal Plains.

Cagle's albino individual was an adult male, total length 440 mm., and was considered normal except for the complete absence of dark pigment; remarkably, this is the only albino individual encountered by Cagle among more than 300 individuals observed.

The five unusual individuals from South Carolina vary in size between 210 mm. and 584 mm. in total length. Of these, three are completely white, except that the eyes have dark pigment. In life, the cutaneous capillaries and the system of head and lateral line pores were readily visible. The three "albino" individuals measure 210, 270, and 515 mm. respectively in total length, and the largest is a male. They appear to be normal in every way except for the lack of dark dermal pigment; costal grooves are particularly difficult to count, but seem to lie within the normal range for *Amphiuma means*.

The remaining two individuals are remarkable in showing a color condition intermediate between the all white specimens and the normally dark brown or black individuals. These specimens measure 400 mm. and 584 mm. in total length, the larger being a male and the smaller a female. The male is completely without pigment on the posterior three quarters of the body and tail; however, the dorsal surface of the head and anterior portion of the body is the usual brown color of *A. means*, the dark pigmentation extending as far ventrally as a line drawn from the angle of the jaws through the external auditory meatus and above the insertion of the forelimb. This dark area is not uniformly brown. The head and dorsal surface of the body as far posteriorly as about 15 mm. behind the forelimb are very dark brown; at this level the dark brown changes abruptly and irregularly to a lighter brown, which in turn remains uniform for the remainder of the pigmented area. Thus, the animal appears somewhat tricolor: a dark brown head and anterior trunk, an area of lighter brown behind the dark brown, and the remainder of the body and tail white.

The second of the two unusually pigmented individuals shows five brown spots: one on the dorsum of the head and fore portion of the body to just posterior to the insertion of the forelimbs, two on the anterior and one on the posterior part of trunk, and one lying above the insertion of the hind limbs and extending onto the dorsal surface of the tail. The body blotches range from 21 mm. to 35 mm. in length, and the spot above the hind limbs and extending onto the tail measures 36 mm. The general appearance of this specimen is distinctly pinto. Within all but one of these five dark areas one may distinguish irregular darker

blotches of dark brown, so that, as in the larger brown-and-white specimen, three distinct colors are present; however, rather than these colors being arranged serially, in the smaller individual the dark brown is superimposed upon the lighter brown, to give a blotchy effect.

Since all five of these unusually colored individuals possess dark eyes, they may not be termed albinos, in the strict sense of the word. Cagle does not mention whether his albino amphiuma had colored or pink eyes. The presence of dark pigment in the eyes indicates that only the dermal pigment system is involved in lack of development of dark pigment granules in the melanophores due to mutation involving the melanin-producing system in the dermis.

Completely white specimens may involve the presence of an inhibitor which prevents the development of melanin granules; pinto individuals might have resulted from local absence of the inhibitor, allowing local development of the normal dark brown coloration. Pinto individuals would appear to be the result of local somatic mutation, allowing for the development of melanin in chromatophores in certain more or less restricted areas. If the causative gene(s) are homologous to the *d* genes of the axolotl (Caspari and Dalton, 1949, Carnegie Institute Wash. Yearbook 48: 188-201), release from melanin-production inhibition would appear to be a two step phenomenon.

Aside from these five abnormally colored individuals, two other small white amphiumae were seen but not collected. The white and pinto salamanders behaved in a normal manner in the field and in the laboratory, and were no more sensitive to either flashlight or daylight than the brown specimens. The five abnormal individuals represent four age groups, and thus are not the direct result of a mutation in a single clutch of eggs.

The survival value of white or pinto coloration in *Amphiuma* is probably very low. The major predators on these large salamanders are the snakes *Abastor* and *Farancia;* it would seem likely that white or pinto salamanders would be even more obvious to these predators than those of the normal brown coloration, which perhaps acts as a camouflage coloration. It is possibly significant that, at the present locality, no snakes of any sort were encountered, and the absence of predators may account for the relatively high incidence and survival of abnormally colored amphiumae in a local population. The absence of *Abastor* and *Farancia* may be more imaginary than real, for the early dates and cool temperatures on which the amphiumae were taken may have precluded any activity on the part of these reptiles. On the other hand, the fluctuating nature of the waters in which the *A. means* were taken is not generally considered as contributing to an optimum habitat for these two predacious snakes.

I wish to thank Edwin L. Blitch, Julian R. Harrison III, and John A. Quinby for assistance in collecting, and William B. Cotter for pertinent discussions in interpreting the genetics involved in the white and pinto individuals.—*Albert Schwartz, Department of Biology, Albright College, Reading, Penna.*

THE EGGS OF THE CROWNED SNAKE, *TANTILLA CORONATA*.—Near Peterson, Tuscaloosa County, Alabama, the authors collected a gravid female of the crowned snake, *Tantilla coronata* Baird and Girard. It was found in leaf litter on a rocky exposure along the Black Warrior River in the vicinity of Lock 13. The specimen is now No.54-289 in the University of Alabama collection. A survey of material in this collection revealed two more gravid females of the species. These (UA 51-252 and 51-296) were from Eight Acre Rock near Vance, Tuscaloosa County. Data on the three snakes appear in Table 1. Measurements of UA 54-289, and of its eggs, were made before preservation. The other two specimens had been preserved in formalin for about 5 years. Subspecific identification is withheld pending further study. The snakes are from the lower portion of the Appalachian Plateau, in which physiographic region the species has not been previously reported.

Two kinds of eggs were present in the snakes' oviducts. Some of the eggs were relatively large, cylindrical, and shelled; others were much smaller, roughly spherical, and without shell. The larger eggs evidently were destined for deposition in the near future; the fate of the smaller ones is uncertain. Snakes of many species often deposit a number of small, unshelled, abortive eggs along with the normal ones. Perhaps this is also the case with *Tantilla coronata*. At any rate, the terms "normal" and "abortive" may conveniently be used to designate the two kinds of eggs observed.

Normal or abortive eggs may occur in either oviduct, as shown by the table. Abortive eggs may be anterior to, posterior to, or interspersed among the normal eggs when both are found in the same oviduct. Normal eggs are arranged in linear fashion when 2 or 3 occur in one oviduct. A normal egg of UA 54-289 was opened. It contained a large quantity of cream-colored yolk, but no embryo was visible to the naked eye. The shell was tough and leathery.

The available data suggest that, as a usual condition, *Tantilla coronata* may produce 8 to 12 ova but only 3 young each year. The few pertinent literature observations do not negate this supposition. Minton (1944, Amer. Midland Nat., 32 (2): 472) mentioned a specimen that "appeared to be an egg-containing female," and elsewhere stated that a crowned snake from Indiana showed "two or three" elongated eggs visible through the semi-translucent ventral plates (1949, Copeia (2): 147). Neill (1951, Pubs. Research Div., Ross Allen's Reptile Inst., 1 (5): 48-49) described a natural nest of this species in Georgia; it contained 3 eggs at the point of hatching. Finally, Cook (1954, Snakes of Mississippi: 31) found 3 eggs in a crowned snake from Mississippi.

Of course, when more gravid females of *Tantilla coronata* become known, some variation is apt to be evident in the number of eggs that produce young. This was the case with the flat-headed snake, *T. gracilis* Baird and Girard. Strecker (1926, Contributions Baylor Univ. Mis., (4): 5-6) found 3 reptilian eggs accompanied by an adult snake of the latter species. Dissection of a flat-headed snake revealed 3 normal and a number of abortive eggs in the oviducts (Force, n. d., The Wild Life of Tulsa County, Oklahoma and Vicinity. Vol. 2. Amphibians and Reptiles).[1]

[1]Bound MS in the University of Florida Library.

Table 1.

Eggs from 3 specimens of *Tantilla coronata*. Dimensions of eggs are indicated parenthetically. Only one axial measurement is provided for abortive eggs, which are roughly spherical.

SPECIMEN NUMBER	LENGTH IN MM	DATE	NO. EGGS IN RIGHT OVIDUCT	
UA 54-289	248	5-25	3 (21.3-23.7 x 5.0-5.6)	0
UA 51-252	250	5-22	3 (15.0-17.0 x 4.0)	3 (1.0-3.0)
UA 51-296	280	5-5	1 (11.0 x 3.0)	6 (1.0-4.0)
			NO. EGGS IN LEFT OVIDUCT	
			0	5 (2.4-3.7)
			0	4 (1.0-3.0)
			2 (11.0 x 3.0)	3 (1.0-3.0)

Further study showed that 2 or 3 normal eggs might be laid (Force, 1930, Copeia (2): 25-39). Eventually, 265 females were dissected; it then became evident that each oviduct contained from 8 to 16 eggs, and that the number of eggs actually deposited was usually 2 or 3 but occasionally 1 or 4 (Force, 1935, Paps. Mich. Acad. Sci., Arts & Letters, 20: 645-659). Apparently, *T. gracilis* produces roughly twice as many ova as *T. coronata*, yet does not lay a significantly greater number of normal eggs.

A photograph accompanying Force (n. d.) portrays a dissected female of *Tantilla gracilis*. Three normal eggs and a number of much smaller ones are to be seen, just as in *T. coronata*.

So far as the authors know, the only additional reference to *Tantilla* eggs relates to the Utah black-headed snake, *T. utahensis* Blanchard; two examples of this species each contained one large egg (Stebbins, 1954, Amphibians and Reptiles of Western North America: 452).—WILFRED T. NEILL, *Research Division, Ross Allen Reptile Institute, Silver Springs, Florida*, and JAMES M. BOYLES, *University of Alabama, Mobile Center.*

AN ALBINO SPECKLED KING SNAKE.—In early August, 1956, the author obtained an unusual snake which had been captured by two farmers near Colbert, Bryan County, Oklahoma, in late July. The identity was not apparent on first observation, since the snake completely lacks dark pigment. Close examination revealed a very faint yellow spot in the center of almost all dorsal scutes, characteristic of the speckled king snake, *Lampropeltis getulus holbrooki* Stejneger, a common species of this area. The eyes were deep pink, indicating true albinism. The suture between the preocular and loreal scales is not present, but other scale characters are normal for this species. This male measures 65.7 cm. body length, total length 75.2 cm.—*Charles C. Carpenter, Department of Zoology, University of Oklahoma, Norman.*

EGGS AND YOUNG OF THE CORN SNAKE IN MARYLAND. —The rarity of the corn snake (*Elaphe g. guttata* Linnaeus) in Maryland is reflected in the almost total lack of information on the natural history of the species in this state. The following data have been accumulated on local specimens under observation at the Reptile House of the Baltimore Zoo.

On June 10, 1954, the zoo received a female, 42.5 inches in total length, from Whitney's Landing, Anne Arundel County, Maryland. When placed in a cage with a male of similar size collected at the same locality in April, mating took place almost immediately. On June 26 the female deposited 12 eggs, 11 of which adhered in a cluster. The eggs were smooth, white and oval. The average weight of the eggs in the cluster was 11 grams; the single egg weighed 12.5 grams and measured 43.8 x 23.0 mm. The eggs were placed in damp wood pulp to incubate and they appeared to do well until early September when they began to mold. On September 8 the eggs were opened and found to contain dead but well-developed embryos. It seems hardly likely that these fertile eggs had any connection with the mating activity described above, in view of the short period following until deposition.

On June 16, 1955, we received another female, 41.5 inches in total length, from Lake Shore, Anne Arundel County. About 9 AM on the 28th of June this snake deposited 14 eggs, all of which adhered in a cluster. The average weight was 8.86 grams at time of deposition. The eggs were placed in a gallon glass jar floored with several layers of damp paper towels. A piece of thick cloth toweling was kept over the mouth of the jar and was dampened daily.

On August 26, at 5:30 PM, a small slit appeared in the shell of one of the eggs. By 8:00 PM of the next day, ten showed one or more longitudinal cuts. The hatchlings remained in the eggs, alternately extending and withdrawing their heads, for at least 48 hours. Six left the eggs on August 28, four on the 29th and one on the 30th.

By September 1, three had not hatched. One was very much shrivelled and discolored, hence was discarded. Another was slit, but there was no evidence of activity of its embryo. It contained a dead but fully-developed snake. The third egg contained a living but incompletely developed embryo that still exhibited the occipital "soft-spot."

These two latter specimens, together with the smallest living hatchling of the clutch, showed an identical and interesting pattern variation. The four corners of the square dorsal blotches were extended to fuse with similar extensions from the neighboring blotches. Practically all of the dorsal blotches in these three were similarly fused. The lateral and ventrolateral series of blotches were also fused to form two longitudinal bands down the sides. Further, there was an almost complete lack of markings on the bellies. These were the only snakes of the group so extremely marked, although there was the usual fusing of a few blotches on all of the hatchlings. Shortly after hatching, the young were weighed and measured. They varied in weight from 6.5 to 10.0 grams and in total length from 302 to 341 mm.

With the exception of the variations already described, the pattern of the young was the same as the average adult, but the intensity of color was markedly different. The ground color of the young was light gray

with fine dark stippling on individual scales, and the dorsal and lateral blotches were very dark mahogany-brown, making a sharp contrast between ground and blotches not evident in adults. The young had a distinct pink tinge on the dorsal surface between blotches, more distinct anteriorly, fading on the posterior half of the body.

Eight of the snakes sloughed on September 6 and another on the 9th. There was no further sloughing until one snake completed the process on October 3, and another on October 13. It is assumed that these two were the ones that failed to shed earlier. The second round of sloughing began on October 14.

Within ten days of hatching and a few days after the first sheddings, the young began to feed on very small mice. Later they greedily accepted small *Anolis*, seeming to prefer them to mice. Mealworms, frogs, and salamanders were consistently refused during the eight months that the snakes were under observation. At no time has constriction been effectively used. A few ineffectual coils are usually thrown about the prey when it is seized, but with little effect except to somewhat deter struggling.

Eight months after the eggs hatched only two of the snakes remain alive. The largest of these measures 393 mm. in total length and weighs 12 grams. There has been a gradual lightening of the dorsal blotches until they are now dark red with black borders. The pink tinge between the dorsal blotches has become rusty orange. The general ground color is still light gray. — *Frank Groves, Baltimore Zoo, Baltimore 17, Maryland.*

EXTENSION OF THE RANGE OF THE DAVIS MOUNTAIN RAT SNAKE.—The Davis Mountain Rat snake, *Elaphe subocularis* (Brown), has been previously known from Mexico, Trans-Pecos Texas and the Guadalupe Mountains and Carlsbad Caverns National Park in New Mexico. A specimen of this snake was obtained 4.0 miles west of Carrizozo, Lincoln County, New Mexico in the Maipas Lava Beds about 7:30 o'clock in the evening of June 29, 1956. The elevation was 5240 feet. The sky was overcast and rain began about 7:35 o'clock. The temperature of the air was 27.6°C., the road 29.4°C. and the snake 29.0°C. (Schulthies, Amer. Mus. Special Animal Thermometer.) The specimen is 1141 mm. in total length. The snout-vent length is 991 mm. There are 283 ventral and 73 caudal plates. The scale row count is 30-34-25. The specimen is a female with 26 body spots and 8 tail spots. This report extends the known range of this snake some 150 air miles north-northwest.—*David L. Jameson, Department of Biology, University of Oregon, Eugene, Oregon.*

ERRATUM.—Vol. 12, Part 4, p. 291, paragraph 3, line 1, read "USNM No. 137833" instead of "USNM No. 00000" for the holotype of *Sceloporus undulatus erythrocheilus* Maslin.